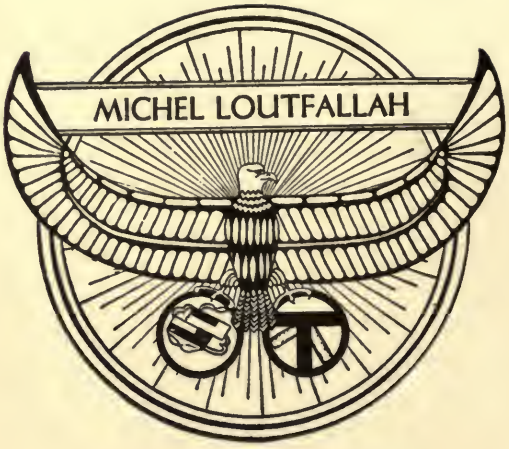

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TRACHOMA

TRACHOMA

By DR. J. BOLDT

Translated by

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TRANSLATOR'S PREFACE

TRACHOMA has recently been brought to the notice of the British people by the Reports of the Royal Commission on Alien Immigration and by the introduction into the House of Commons of the Aliens Immigration Bill. The present time, therefore, seemed a suitable opportunity for publishing a monograph on the subject, the more so as an excellent one lay ready to hand in the German language. This work, written by Dr. J. Boldt, Upper Staff-Surgeon and Regimental Surgeon to the Ninth West Prussian Infantry Regiment, No. 176, was published in Germany at the close of last year. It embodies the results of many years' experience in one of the Continental hotbeds of the disease, and contains the most complete list of statistics which has yet been collected. At the same time it provides a concise description of the whole subject.

Trachoma in England at the present day is an alien disease, imported by aliens, propagated amongst aliens, and handed on to the native population by aliens. Its importance, therefore, in this connection can scarcely be overestimated. Consistent with our well-earned reputation for international philanthropy, we are indeed acting as a Trachoma filter-bed to the United States. It is astonishing that so little stress was laid upon this important aspect

of the question both by the Royal Commission and by the supporters of the eminently desirable Aliens Immigration Bill.

I have been fortunate in being able to supplement Dr. Boldt's account by the statistical researches and experienced observations of Mr. Treacher Collins. These have been set forth in an Introductory Chapter, which will be of special interest to English readers, dealing as they do with Trachoma at home and in our dependencies. The account of the work of the recently instituted Ophthalmia Schools of the Metropolitan Asylums Board, directed by Mr. Treacher Collins himself, will not fail to attract attention.

It must not be forgotten, however, that we have a much wider, Imperial interest in the question. Only too large a proportion of His Majesty's Indian subjects suffer from Trachoma, and the government of Egypt carries with it the responsibility of a native population infested with the disease. The generous enterprise of Sir Ernest Cassel inaugurates a new era, in which for the first time a serious and determined attempt is being made to cope with the scourge. It cannot be doubted that the work thus instituted will gather strength and support, to be rewarded by the alleviation of suffering, and eventually by the happiness, well-being, and increased efficiency of a once mighty race.

J. HERBERT PARSONS.

INTRODUCTORY CHAPTER

By E. TREACHER COLLINS

For the elucidation of the natural history and ætiology of a disease like Trachoma it is essential that observations from all parts of the world should be collected and sifted, in the thorough and impartial way which has been done by Dr. Boldt in the following pages.

The errors and false conclusions which are likely to arise from the study of it from too limited a standpoint, or in a petty and provincial manner, are well shown by the widely conflicting opinions quoted in this book.

Thus the affection, when it became epidemic in Northern Europe at the beginning of last century, was termed "Egyptian Ophthalmia," because it was disseminated by soldiers who had acquired it in that country. It was, however, at that time, and is now, equally endemic in other countries besides Egypt—for example, Syria, Persia, Central Asia, China, and Japan. Had Napoleon's ambition led him to sit on the throne of Jamshyd instead of that of the Pharaohs, there can be little doubt that the affection would have been introduced to Europe as the Persian malady.

The marked prevalence of the affection at first amongst soldiers led to the use of the term "Military Ophthalmia," and to the belief that it was one which was exclusively confined to them, the civil population being exempt. Various articles of a soldier's equipment were condemned as being concerned in its causation, and even the cut of his hair.

Those who have had to contend with the disease in hot, arid countries, such as Arabia and Egypt, have attributed

its wide dissemination to the dryness of the atmosphere and the dust; whilst those who have recorded its extreme frequency in damp countries, such as Finland and Ireland, have thought the moistness of the atmosphere and marshy character of the soil particularly favourable to its prevalence.

The comparative freedom of the Swiss from Trachoma led to the theory that an altitude of 200 metres was prejudicial to its spread. It has since been pointed out that there are several districts in Europe 400 and 600 metres above the sea level where it is fairly prevalent, and the writer can testify to its extreme frequency amongst the tribes who inhabit the mountainous district to the west of Persia.

The comparative infrequency of Trachoma in parts of France led some to regard the Celts as enjoying a certain degree of immunity to the disease. On the other hand, its frequency amongst the Irish has led to its being asserted that the Celts are, as a race, particularly prone to be affected.

The alleged predisposition of Jews to Trachoma, which has been so strongly held by some in this country, shrinks into insignificance when we consider that the well-to-do Jew is as free from the disease as his Christian neighbour; and that it is in those who are wanderers on the face of the earth, or who are herded together in the poorest and dirtiest quarters of large towns, in whom it is so rife.

Throughout Asia Trachoma is found to be no respecter of race, the Aryan, Semitic, and Mongolian suffering with equal and terrible frequency.

Out of all the confusing and contradictory observations which have been made in connection with Trachoma, the contagious character of the affection stands to-day clear and and undoubted.

It is satisfactory to note that from its first appearance in this country in epidemic form its contagious character has been recognised. It spreads by the direct or indirect

transference of the moist discharge from one person's eye to another, and conditions which favour such transference are predisposing causes to its dissemination.

It may under favourable conditions exist and spread in any part of the world into which it is introduced; but it is also important to note that, by the observance of a few simple precautions, individuals may live surrounded by those suffering from the disease without becoming affected.

The history of the disease in the British army and in the London Poor Law schools affords such striking evidence on these points that I think it will be of interest to give here a more extended account of them than has been done by Dr. Boldt.

The history of Trachoma in this country practically dates from the return of Sir Ralph Abercromby's troops from Egypt in 1801 and 1802.

Most of the writers who described the ophthalmia which appeared here at that time laid stress on the purulent character of the discharge, the acuteness of the symptoms, and the rapid and destructive ulceration of the cornea which was liable to ensue—characteristics which we associate to-day with gonorrhœal ophthalmia rather than Trachoma.

Koch,[1] while in Egypt in 1883, found in the conjunctival discharge in cases of Trachoma two different kinds of micro-organisms—the gonococcus, and what is now known as the Koch-Weeks bacillus. Neither of these can be regarded as the specific organism of Trachoma. The cases had therefore a mixed infection.

In many cases of Trachoma in this country now the Koch-Weeks bacillus is found in the muco-purulent discharge from the conjunctiva which occurs during an acute exacerbation of symptoms. The ophthalmia which was introduced by the troops from Egypt was most likely then, not one disease, but a mixed type, much of it being gonorrhœal as well as trachomatous. The alteration in the intensity of the symptoms which has taken place

[1] *Koch*, Wiener med. Woch. 1883.

is due to the absence at the present time of the gonorrhœal element.

Ware,[1] writing on the subject in 1808, said that the so-called Egyptian affection resembled gonorrhœal ophthalmia, with which he was familiar, and that a disease precisely similar in its symptoms and progress had appeared long ago in this and other countries.

Sir William Lawrence[2] in his *Treatise on Diseases of the Eye*, in 1833, shrewdly remarked: "I cannot help thinking that it has existed in this country long before our intercourse with Egypt. Its not having been described does not prove its non-existence; the distinction between smallpox and measles, and between that latter and scarlet fever, are not of old date."

In Ireland epidemic ophthalmia was of frequent occurrence, amongst the peasantry during the eighteenth century, and according to Power,[3] who wrote on Egyptian ophthalmia in 1803, it was "a species of the same disease," and was considered infectious.

So early as 1701[4] an epidemic of ophthalmia is recorded near Castle-Town-Delvin, in the county of West Meath, "by which vast numbers lost their eyesight," and which may have been gonorrhœal ophthalmia or Trachoma.

As an example of the serious results which the disease occasioned in the Army, Dr. Vetch's[5] summary of what happened in the second battalion of the 52nd Light Infantry may be quoted: "The total strength was somewhat above 700 men. Six hundred and thirty-six cases of ophthalmia, including relapses, were admitted into the Hospital from August, 1805, when the disease commenced, till the same

[1] *Ware*, Remarks on the Purulent Ophthalmy which has lately been Epidemical in this Country, 1808.

[2] *Lawrence*, A Treatise on the Diseases of the Eye, 1833, p. 204.

[3] *Williams, John*, The Ophthalmia of Ireland, 1857.

[4] *Wilde, W. R.*, London Journal of Medicine, Vol. III. 1851, On the Epidemic Ophthalmia which has prevailed in the Workhouses and Schools of the Tipperary and Athlone Unions (footnote).

[5] *Vetch, John*, An Account of the Ophthalmia which has appeared in England since the Return of the British Army from Egypt, 1807.

month in 1806; of these, 50 were dismissed with the loss of both eyes, and 40 with that of one."

Mr. Patrick Macgregor,[1] Surgeon to the Royal Military Asylum, writing in 1811, said that the returns of Chelsea and Kilmainham Hospitals showed that 2,317 soldiers were, on December 1st, a burden upon the public from blindness in consequence of ophthalmia, those who had lost the sight of only one eye not being included.

He further wrote: "The progress of the ophthalmia since its first introduction into this country in the year 1800 has, in the army, been very rapid and extensive, and has at different periods materially interfered with its discipline and efficiency. It has crippled many of our best regular regiments to such a degree as for a time to render them unfit for service; and though the regiments which were in Egypt have, in general, suffered most from the disease, yet it has prevailed extensively in others which never served in that country."

So serious to the army had the prevalence of ophthalmia become in 1810, that the Commander-in-Chief appointed a committee of eminent professional men to consider the best means to take for its prevention and for its cure.

Under the head of prevention the Committee made the following excellent recommendations:—

"*First.*—As the purulent ophthalmia appears to be communicable principally by means of morbid matter applied to the eyes, one of the most obvious modes by which it may be prevented from spreading is the immediate separation of those who have caught the disorder from the rest of their comrades and associates. As soon, therefore, as the disorder is discovered to exist in a regiment, the Board is of opinion that the surgeon or his assistant should daily inspect the eyes of all the soldiers; and if there be the smallest appearance of inflammation in any of them, these should be immediately removed from the rest, and be sent

[1] *Macgregor, Patrick*, Trans. of a Society for the Improvement of Medical and Chirurgical Knowledge, Vol. III. 1812.

to the hospital or depôt, in order, not merely that the disease may be prevented from being communicated to others, but that proper remedies may be employed, in the most expeditious manner, to arrest its progress in the persons who suffer under it.

" *Secondly*.—Cleanliness, as a means of prevention, is of such high importance that it cannot be urged too forcibly. In this part of the Report, the Board is of opinion that it cannot object in too strong terms to a practice which has been very commonly pursued in the army, and in many other confined situations—that of permitting a number of persons to wash their faces, in succession, not only in the same tub or basin, but with the same water. This practice should be peremptorily prohibited in all his Majesty's regiments, particularly in those where the purulent ophthalmia has prevailed; and instead of it, the men should be obliged to wash their faces in a running stream, either from a pump or a closed cistern, under which there is not any receptacle for the waste water; and instead of wiping the face with a towel common to many, each man should be supplied with one for his own use; and he should be strictly prohibited from lending or borrowing any article of this kind. For greater security in this respect, the Board recommends that those men who suffer under the ophthalmia may be provided with a towel having a distinguishing mark, such as a coloured border. These marked towels should be kept separated from the rest and should not be washed by the common washerwoman, but by a person appointed for the special purpose.

" *Thirdly*.—The bedding and clothes of those who have the purulent ophthalmia are liable to be so much imbued with the discharge that issues from the eyes, as to become a possible cause of communicating the disorder to others. The Board recommends that these be frequently washed and scoured; and as the bolsters and sheets are particularly liable to be thus imbued, the bolsters should be covered with linen cases, and these as well as the sheets be

frequently and thoroughly washed and cleansed. If this work be properly performed, it does not appear to the Board that these articles need be destroyed. This remark may be applied also to the towels, and to most other things, of a similar kind, that are employed by the nurses and patients. Sponges, from their porous texture, furnish an exception to the above rule; these it may be better to destroy than to return into store."

This report was, by the command of the Commander-in-Chief, circulated for the information of the commanding officers of regiments, and for the guidance of all medical officers belonging to the army.

Thorough as these regulations were, it was a long time before they produced any marked effect in checking the spread of the affection—probably because to do is not as easy as to know what 'twere good to do.

With regard to Malta, Surgeon-Major Keith Adams,[1] writing as late as 1870, said: "There are few military stations more infected by ophthalmia. It is always present among the lower classes, and seldom regiments pass their time in the island without becoming more or less tainted; indeed, there is no element hitherto ascribed either favourable towards its production or propagation that does not exist there to the fullest extent. So marked is this that a corps is considered fortunate indeed should it escape after three years' residence in their badly constructed barracks."

Ophthalmia adhered with a most inveterate persistency to some regiments, notwithstanding their transference to stations in various parts of the world.

In all the stations in which the British troops were quartered, ophthalmia flourished[2]—Mauritius, Cape Town, the Frontier, Ceylon, West Indies, Jamaica, Ionian Isles, Malta, Gibraltar, Bermuda, Nova Scotia, and Canada—but not in all to the same extent.

[1] *Adams, Surgeon-Major Keith*, Army Medical Depart. Report, 1869, Appendix XIV.

[2] Army Medical Depart. Report, 1863, pp. 343-4, Ophthalmia in the Army.

Assistant-Surgeon Welch[1] wrote in 1870: "The prevalence of the disease under different climates varies greatly, constituting—

$\frac{1}{11}$th	part of	admissions	with	16·7	per cent. discharges	at the Cape of Good Hope.
$\frac{1}{15}$th	„	„	„	12·47	„ „	in the Mediterranean.
$\frac{1}{37}$th	„	„	„	2·47	„ „	in North America.
$\frac{1}{38}$th	„	„	„	6·3	„ „	in India.
$\frac{1}{51}$st	„	„	„	2·1	„ „	in the United Kingdom.

Malta, the Cape, and some of the stations in India—notably the Northern and Scinde districts in Bombay and certain garrisons in the plains of Bengal and Madras—are the quarters of the army on foreign service maintaining a high general average, the remainder fluctuating greatly."

There was an increase in the amount of the ophthalmia noted in the Mediterranean stations at the time of the Crimean War,[2] which was attributed to overcrowding of the barracks by the largely increased garrisons. Ophthalmia prevailed to a considerable extent in several regiments during the Indian Mutiny.[2] About the second half of the nineteenth century a gradual decrease in the amount of ophthalmia in the army commenced.

Thus Welch[1] notes: "From 1861-7 inclusive, while the annual average ratio of admissions from all diseases for the whole army, calculated per 1,000 of strength, was 1,114, ophthalmia contributed 42·9—the one disease furnishing rather more than $\frac{1}{26}$th part of the whole temporary inefficiency in the service; and during the same period the permanent loss was 1,572, or 4·8 per cent. of total discharge from the army. As contrasted with the decennial period 1837-46, during which the average annual admissions from ophthalmia amounted to 80 per 1,000 of strength, or rather more than $\frac{1}{12}$th of whole sickness, a marked decrease in the prevalence of the disease is apparent, more especially during the later

[1] *Welch, Assistant-Surgeon*, Army Medical Depart. Report, 1869, Appendix XV.
[2] *Frank, Dr. Philip*, Army Medical Depart. Report, 1860, p. 400.

septennial period 1861-7, ranging from $\frac{1}{20}$th of total admissions in 1861 to $\frac{1}{32}$nd in 1867; with a corresponding decrease in discharges from the service from 5·4 per cent. in 1861 to 3 in 1867—an all but gradual subsidence both in prevalence and amount of impairment characterising this period."

On its being decided in 1882 to send an expedition to Egypt under Sir Garnet Wolseley, afterwards Lord Wolseley, to suppress the rebellion of Arabi Pasha, the precautions which were to be taken to guard the troops from ophthalmia naturally became a matter of the most careful consideration.

A blue veil and a pair of goggles were issued for each man, and medical officers were instructed to see that they were used, kept clean, and in good order. The latter had also to make frequent and special inspections for any signs of ophthalmia.

Under the heading "Sanitary Precautions"[1] the following order was issued:—

"The eyes should be freely bathed on every favourable opportunity when the water is clean and pure; but if the latter is suspicious or turbid, the eyelids should be kept firmly closed when the face is being washed and dried; this is very important.

"If possible, the same water should never be used by two or more men. Here, again, if necessity demands that it should be so used, the eyes should be firmly closed. Every man should use his own towel, and that only; and the towels should be washed daily if possible. Any indications of tenderness or sense of grittiness in the eyes should at once be brought to the notice of the medical officer, and officers should impress the importance of this point on the non-commissioned officers and men. The wearing of goggles in the bright sun should be insisted on."

These precautions worked and all went well until after

[1] *Hanbury, Deputy-Surgeon-General Sir J. A., K.C.B.*, Medical History of the War in Egypt in 1882. Army Medical Depart. Report, 1881, p. 204.

the battle of Tel-el-Kebir. Then in the excitement of the march on Cairo, with its dust, dirt, and insufficient water supply, they broke down; and almost immediately after the troops had concentrated at Cairo an epidemic of ophthalmia supervened.

Vigorous measures for its suppression were instituted, "the points especially insisted upon being segregation, cleanliness, abundance of cubic space, ample supply of water, towels for separate use, settling the dust in the neighbourhood of all camps by water-carts, daily inspections of every man in the force for the early detection of disease."

Between July 17th, 1882, and January 29th, 1883, there were 1,783 cases of ophthalmia; on the last-named date only 11 remained under treatment. The ratio of those attacked was estimated as 87·5 per 1,000; 329, or 25·28 per 1,000, were transferred on board ship to Malta or England.

As at the beginning of the nineteenth century in this country, so here, several different types of the disease were encountered and much mixed infection. Some cases were of a purulent character of great severity, others of a muco-purulent type; and in many the sago-grain granulations typical of Trachoma were present. So efficacious was the treatment adopted by the medical officers that in no case was there any loss of sight—a striking contrast to what happened when the disease was acquired under similar circumstances some eighty years previously.

Trachoma was practically unknown amongst our troops during the late South African War. Mr. L. V. Cargill, who was ophthalmic surgeon to the Imperial Yeomanry Hospital in South Africa, informs me that amongst the troops which came under his immediate observation there was not a single case of active Trachoma; but there were two or three who came under him for other reasons who showed evidence of past Trachoma.

Through the kindness of Deputy-Surgeon General Keogh and Major McCullock I am able to conclude this account

of ophthalmia in the British army by giving a return of the number of admissions for Trachoma from 1896 to 1902, and the names of the stations at which they occurred :

1896. Madras, 1; Mandalay, 2; Rangoon, 1; Ramklet, 1; Fyzabad, 1; Wellington, 4. *Total*, 10.
1897. Kamptee, 1; Meerut, 1; Poona, 1; Rangoon, 1. *Total*, 4.
1898. Fatshgarh, 1; Fyzabad, 1; Madras, 1; Meerut, 2; Mhow, 1; Peshawur, 1; Shwebo, 1; Solon, 1; Amballa, 1. *Total*, 10.
1899. Fort Allahabad, 1; Barrackpore, 1; Mhow, 2; Nowshera, 2; Secunderabad, 1; Sabatha, 1. *Total*, 8.
1900. Barrackpore, 1; Kirkee, 2; Landour, 1; Mhow, 3; Nowshera, 1; Sabatha, 1. *Total*, 9.
1901. Agra, 1; Mhow, 1; Manothir, 1. *Total*, 3.
1902. No admissions were reported.

It will be seen that during the last seven years all the recorded cases have occurred in foreign stations, mostly in India. This extermination of the disease in the army is attributed by the authorities to every soldier having his own towel, the unlimited supply of water, and the better ventilation of the barracks, cubic space being carefully attended to.

The satisfactory way in which the British army has managed to free itself from this disease encourages the hope that it may, by degrees, also be exterminated from the civil population of Great Britain.

Some parts of the country are already practically free from it, cases of Trachoma being a rarity in the eye clinics in those districts, and only met with in people who have strayed from other parts where they contracted the affection.

Thus, Dr. Usher, of Aberdeen, informs me that during the last three years there has only been one case of Trachoma at the Royal Infirmary out of 1,077 ophthalmic out-patients.

Dr. A. M. W. Sutherland examined 400 school children for a Physical Training Commission of the Scotch Education Board, and did not meet with a single case of Trachoma among them.

In Ipswich and the neighbourhood the disease is practically unknown. Dr. W. W. Sinclair says that since the opening of an eye department at the East Suffolk and Ipswich Hospital in 1896, there have been 7,397 out-patients, and amongst these only two cases of Trachoma, both of which came from London.

At Nottingham, Mr. E. C. Kingdon writes: "Trachoma is practically an unknown disease. The few cases that are seen at the Infirmary are chiefly from other towns, Leeds, Bradford," etc. He looked through his cases for the past three years and found the diagnosis of Trachoma in 15 out of 7,000—0·21 per cent.

Mr. H. V. McKenzie, at Torquay, during the last six years, has had 19 cases of Trachoma at the Torbay Hospital out of 3,680 ophthalmic patients—0·51 per cent. He says that when he first went to Torquay he was told that Trachoma was unknown there; he felt very sceptical in the matter, and in all the 19 cases he has seen has made careful inquiry and found that every one has been imported from elsewhere.

In some towns there has been a slow but steady decrease in the proportion of Trachoma cases to patients with other eye affections. Thus Dr. McGillivray sends me the following figures for the last 10 years from the Dundee Eye Institution:

Year.	Total No. of Patients.	Trachoma Cases.	Percentage.
1893	1,572	20	1·27
1894	2,411	38	1·57
1895	2,838	32	1·12
1896	2,973	45	1·51
1897	2,926	24	0·82
1898	3,072	20	0·65
1899	3,060	22	0·71
1900	3,046	18	0·59
1901	3,549	20	0·56
1902	3,328	16	0·48

In the following table will be found compared the

proportion of Trachoma cases to other patients at different times in various eye hospitals in the country:

Name of Town and Institution.	Source from which Particulars were Obtained.	Period.	Total Number of Ophthalmic Out-patients.	Number of Trachoma Cases	Percentage of Trachoma Cases.
Manchester, The Royal Eye Hospital.	A. Hill Griffith.	1883 to 1892.	168,417	1,387	0·82
	" "	1893 to 1902.	224,181	1,548	0·69
Sheffield, General Hospital.	Simeon Snell (quoted in Stephenson's *Epidemic Ophthalmia.*)	previous to 1895.	5,500	40	0·72
	Simeon Snell.	1889 to 1903.	—	—	0·72
Bradford, Eye and Ear Hospital.	A. Little.	1892 to 1897.	27,096	60	0·22
	"	1898 to 1903.	31,429	59	0·18
Birmingham, Eye Hospital.	Henry Eales (quoted in Stephenson's *Epidemic Ophthalmia.*)	2 years previous to 1895.	37,004	51	0·13
	P. J. Hay.	1901 to 1903.	76,538	32	0·041
Liverpool, Eye and Ear Infirmary.	Hugh E. Jones.	1887 to 1889.	18,648	186	0·99
	" "	1895 to 1897.	18,126	138	0·76
	" "	1901 to 1903.	20,134	93	0·46
Cardiff, Infirmary.	Tatham Thompson (quoted in Stephenson's *Epidemic Ophthalmia.*)	11 months previous to 1895.	1,880	15	0·79
	Tatham Thompson.	1901 to 1903.	11,475	52	0·45
Glasgow, Eye Infirmary.	Freeland Fergus (quoted in Stephenson's *Epidemic Ophthalmia*).	1850 to 1894.	222,636	1,586	0·712
	Leslie Buchanan.	1895 to 1903.	170,314	645	0·37
Dublin, Royal Victoria Eye and Ear Hospital.	A. H. Benson (quoted in Stephenson's *Epidemic Ophthalmia*).	13 years previous to 1885.	64,223	2,494	3·88
	R. Ewart Cree.	1901 to 1903.	24,553	692	2·81

The writer is much indebted to those named in the second column for kindly supplying him with the figures. Some figures quoted from Stephenson's *Epidemic Ophthalmia* have been introduced for comparison.

In each town, with the exception of Sheffield, a decrease in the percentage of Trachoma cases is shown to have taken place. In Sheffield the percentage has remained the same.

In quoting these statistics it is well to mention that

there may be several fallacies in connection with them. All surgeons are not agreed as to what symptoms are requisite to warrant the diagnosis of Trachoma, and in some institutions the diagnosis has been made by different members of the staff; the figures have been drawn up from out-patient records in many cases at different times by different compilers; of late years there has been more differentiation between Follicular Conjunctivitis and Trachoma than formerly; at most eye clinics the number of cases applying for correction of errors of refraction have increased.

As to the amount of Trachoma in London, the writer knows of no reliable statistics available which afford any indication of its increase or decrease of recent years. From his own patients at the Royal London Ophthalmic Hospital he has been able to draw up the following estimate of the proportion of cases which have come under his care there during the last four years.

It should be remarked, however, that a large number of the patients with Trachoma met with in London are Jews, who mostly attend at the hospital on Saturdays. The figures from the writer's clinic, therefore, underestimate the proportion of Trachoma cases coming to the hospital, as he attends only on Mondays and Thursdays.

Year.	Total No. of Patients.	Trachoma Cases (Active and Passive).	Percentage.
1900	3,309	21	0·63
1901	2,937	19	0·64
1902	2,873	13	0·45
1903	3,200	30	0·93

In some parts of London Trachoma is much commoner than in others, and more cases are seen at the hospitals situated in the East End than at those in other districts.

A large amount of the Trachoma in London has, for many years, been generated in its pauper schools. The first of these schools was opened in 1849, the last in 1887, but most of them in 1853 and 1854. Almost from their

commencement ophthalmia has been prevalent amongst their inmates, though varying in amount at different times.

From 1858 onwards the advice of different ophthalmic surgeons has been sought as to the best methods of dealing with the disease.

In 1870 Mr. George Critchett was asked to visit the North Surrey School at Anerley. In his report [1] he stated that he "found a large proportion of mild ophthalmia, which in most cases did not render the patients incapable of following the usual educational course, and he advised the establishment of a ward or separate school, where all such cases might be kept for an indefinite time until it was quite certain that they would not relapse, where they might be under such special hygienic and medical treatment as seemed necessary, where their instruction and education should go on as if they were in the body of the school, and where, by prolonged isolation, they might be prevented from acting as sources of contagion to the healthy children in the school."

Action was not taken on this advice until 1873, when it was tried in an experimental way. All the children in the Anerley School who showed the slightest sign of past or present ophthalmia, numbering about 400, were removed to a separate branch establishment, an unoccupied workhouse at Bow, which was kept going as a combined infirmary and school, with a liberal and efficient staff of teachers, nurses, and other officers for a period of twelve months, Mr. Nettleship acting as resident medical superintendent.

The result was eminently successful, and proved that Mr. Critchett's suggestion was a practical one. Mr. Nettleship found, however, that in many cases the isolation and treatment required to be kept up for a much longer period than a year before the cases could be considered free from the liability to relapse, or sufficiently cured to be fit again to mix with healthy children.

[1] *Nettleship, Edward*, Report on Ophthalmia in the Metropolitan Pauper Schools, 1875.

In 1874 Mr. Nettleship, at the request of the Local Government Board, made an inspection of the eyes of all the children in the Metropolitan Poor Law Schools, 8,798 in number; of these he estimated that 1,300, or 15 per cent., had various degrees of active ophthalmic disease, and stated: "There can be no doubt that the best of all ways for getting rid of the present dead weight of actual ophthalmia and of cases with bad granular lids would be to separate them from all the other children and to keep them separate for an indefinite time, until it was quite certain that all tendency to relapse had ceased."

This policy of isolating cases of ophthalmia was adopted for a time in connection with one or two other schools. The first well-organised attempt to put Messrs. Critchett and Nettleship's recommendation into practice was, however, at Hanwell.

The Central London District School there had hardly ever been free from ophthalmia since it was first opened, and had had several severe outbreaks. In 1888 the condition of things at the school attracted considerable public attention, and, after consultation with Mr. Nettleship, the Managers decided to erect an isolation school to accommodate about 400 children. This was done at the cost of £30,000, the building being opened the following year, and Mr. Sydney Stephenson appointed Ophthalmic Surgeon to the school. As the result of its establishment he wrote in 1895 to the following effect[1]: "In 1889 the proportion of inmates at the Hanwell School affected with ophthalmia was about 33 per cent. In June, 1893, the proportion of ophthalmic patients sank to 7 per cent. of the school population, while two years later it stood at ·5 per cent."

The success of the Hanwell School naturally made it desirable that similar means of isolation should be provided for the children with ophthalmia in other Poor Law Schools.

[1] *Stephenson, Sydney*, Epidemic Ophthalmia, 1895.

In 1893, the number of patients in the Hanwell Ophthalmic School having dwindled down to 101, the Managers, at the request of the Local Government Board, agreed to receive patients from other metropolitan unions, parishes, and school districts into it, so far as its accommodation would permit.

In 1897 the Local Government Board issued an order imposing on the Metropolitan Asylums Board (who had signified their willingness to undertake the work), amongst other duties, that of providing accommodation for children suffering from ophthalmia or other contagious diseases of the eye in the Poor Law Schools of the metropolis.

In the same year was published a Report,[1] made at the request of the Local Government Board, by Mr. Stephenson, on the ophthalmic state of the Poor Law children, 13,047 in all.

The following table which he constructed, comparing his results with those of Mr. Nettleship in 1874, shows the satisfactory decrease in the amount of Trachoma which had taken place in twenty-two years :

	1874.	1896.
Total seen	8,798 ...	13,074
Discharge	11·90 per cent.	4·06 per cent.
Trachoma or "bad granular lids"	42·00 ,, ,,	4·91 ,, ,,
Ophthalmic corneal change ...	9·10 ,, ,,	1·28 ,, ,,

The Metropolitan Asylums Board at first proposed to take over the Hanwell Ophthalmic School and to establish two others. The Managers at Hanwell, however, requiring their school for other purposes, it was ultimately decided to erect two schools to accommodate 360 children each. Suitable sites for these were obtained at Swanley, in Kent, and at Brentwood, in Essex.

The White Oak School at Swanley was opened for patients in March, 1903, and the High Wood School at Brentwood is now ready for occupation. The writer has

[1] *Stephenson, Sydney*, Report on the Ophthalmic State of Poor Law Children in the Metropolis, 1897.

been appointed visiting ophthalmic surgeon to the two schools.

The arrangement of each school is essentially the same. The site at Swanley, comprising 49 acres, was purchased at a cost of £5,050, and the buildings were erected for the sum of £112,324.

At the entrance is the gate-porter's lodge and the receiving block, with an ophthalmoscope room, laboratory, and dispensary. There are 30 cottages for children arranged in 15 pairs, and in 5 groups of 3 pairs. Each cottage accommodates 12 children and a house-mother. In connection with each of the 5 groups is a small staff block, containing a room for the medical treatment of the 72 children in the group, and quarters for a charge nurse who carries out this treatment, a cook-general, and a general servant. The heavier part of the cooking for the group is done in this block.

There is also a central administration block; a junior and a senior school, the latter containing a medical room, in which the children are inspected by the ophthalmic surgeon; a laundry; an infirmary; and an isolation cottage.

Arrangements have been made for all the washing and bathing of the children to be done under running water, spray taps and spray baths having been provided in all the lavatories in all the cottages. Around the walls of the lavatories numbered pegs have been fixed, so that each child's towel can be reserved for its exclusive use. Tow, which is destroyed after once being used, is employed in the place of any flannels or sponges.

One of the results of the establishment of the Hanwell Ophthalmic School was to afford very strong evidence as to the improbability of ophthalmia being an air-borne disease. Thus Mr. Stephenson writes[1] in 1895: "The institution has been occupied for nearly five years, yet not a single nurse out of the sixty-five who have worked in its

[1] *Stephenson, Sydney*, Epidemic Ophthalmia, 1895.

wards has contracted the disorder. Moreover, none of the sixteen teachers have been infected, notwithstanding the fact that they necessarily come into contact with patients. Further, none of the wardmaids or other servants have been attacked. Had ophthalmia been capable of transmission through the air, it must surely, according to the law of averages, have affected many of these exposed individuals. The fact is significant, too, that all preventive measures have been based on the theory that contagious eye maladies are spread by the direct or indirect conveyance of specific discharges from eye to eye."

This eminently satisfactory statement might possibly be taken as an argument against the contagious nature of Trachoma. It is well, therefore, to mention that during the first year that the White Oak Ophthalmia School at Swanley was open, two of the attendants contracted Trachoma, a house-mother and an assistant nurse. In one case there was a history of some water having splashed into the woman's eye while she was engaged in washing a child who had Trachoma, and it was from that time that the onset of the affection dated.

The mode of onset of the disease in these two cases is of interest, as they were seen from the very commencement. In both the symptoms at first resembled those of an acute muco-purulent ophthalmia. There was swelling and redness of both ocular and palpebral conjunctiva, some papillary enlargement of the latter, and muco-purulent discharge. The symptoms, however, did not yield to treatment in the satisfactory way which is usual in that affection, and when the congestion of the palpebral conjunctiva had somewhat subsided, the typical lymphoid follicles of Trachoma became apparent. In one case the affection has remained confined to one eye, in the other both eyes ultimately became involved.

The X-ray treatment of Trachoma, first suggested and practised by Mr. Stephen Mayou, has been given an extensive trial at the White Oak School, Swanley.

It has been employed in about forty cases, without any other treatment beyond the use of some simple lotion to wash away discharge, in association either before or after with the use of caustics, and subsequent to the operation of expression.

Mr. Mayou claims as advantages of the treatment that:

(i) It is free from pain;

(ii) there is considerably less deformity of the lids afterwards;

(iii) the pannus clears more thoroughly;

(iv) the period of treatment is shortened.

The experience of this treatment at White Oak School tends to substantiate these claims. The employment of it, however, requires to be carried out with much care and discretion, and to obtain thoroughly satisfactory results it is necessary to be able to retain the patient under regular observation for a long time.

At White Oak School all the exposures to X rays have been made by Mr. F. A. C. Tyrrell, the assistant medical Officer, and the results accurately noted by him.

The patients have been seated with the affected eye 12 inches distant from the Crookes' tube and the upper lids held everted by a Reid's clamp. The cornea, unless affected with pannus, has been kept covered by allowing the eye to roll up or by sliding the lids over it.

The average strength of the current employed has been 10 volts. The length of the exposures has varied from three to five minutes, and in nearly all instances they have been administered daily for the first week.

The rapidity with which a reaction has come on and its amount have varied considerably in different cases. In some cases after a week's exposures there has been a decided increase in the amount of conjunctival injection and secretion; in others, an equal amount of reaction has not been produced until after a much more prolonged use of the rays.

As a rule, after the exposures have been made daily for one week, they have been employed alternate days for the following week, and after that discontinued for a time until the amount and character of the resulting reaction becomes manifest.

In one case, proceeding in this cautious way, in the course of nine months 70 exposures have been made, with the result that much papillary hypertrophy has disappeared, and large lymphoid follicles have gradually decreased in size and number, though a few still remain.

Another case had much follicular and papillary enlargement all over the palpebral conjunctiva, together with pannus over the upper two-thirds of each cornea. Vision was reduced to $\frac{4}{60}$ in the right eye and $\frac{6}{36}$ in the left. Twelve exposures of three minutes each were made, and at the end of seven weeks the pannus had disappeared, vision then being equal to $\frac{6}{24}$ in the right eye and $\frac{6}{18}$ in the left. The condition of the conjunctiva continued steadily to improve, and at the end of six months the case was discharged cured.

After a decided reaction has once been produced and has subsided, a fresh reaction is very easily reproduced.

Applications of caustics after a reaction has once been excited by X rays tend to produce a greater reaction than their use under other circumstances would do.

If a case has been treated for some time with copper sulphate, and is then exposed to X rays, reaction is more readily excited than where no caustic applications have been previously applied.

Some of the best results have been effected when the lymphoid follicles have been first expressed with forceps and exposures to X rays commenced a week later.

In several cases marked and rapid improvement in the pannus has been produced by the X rays, the blood-vessels disappearing and the cornea clearing in a most satisfactory way.

In some cases an increase of inflammatory symptoms

occurs, and it is doubtful whether they are due to a natural exacerbation of the disease or to reaction from treatment. In such cases it is difficult to determine whether it would be better to continue or suspend the treatment.

About six cases have been treated with radium. A tube of radium bromide has been held over the everted eyelids for five or seven minutes daily. This has had to be continued for from three to ten weeks before any reaction was produced. If the exposures to the radium could be made for half an hour at a time, treatment with it would probably prove more efficacious. It would, however, be tedious to both patient and nurse to hold a tube over the everted lids for so long a time.

The considerable diminution in the amount of ophthalmia in the Poor Law schools, which is shown by the comparison of Mr. Nettleship's Report with that of Mr. Stephenson, is due not only to the establishment of the Hanwell Isolation School, but also to a general improvement of the structure and arrangements of the Poor Law schools themselves. Though much has been done in this direction, it is evident from Mr. Stephenson's Report [1] that there is still much which remains to be effected. Thus he says: "It is a striking fact that of the schools found in a bad ophthalmic state by Mr. Nettleship twenty-two years ago, some still occupy that undesirable position. Between then and now there is, however, one great difference—namely, that the absolutely bad condition of 1874 has been converted into the relatively bad condition of 1896. Among district schools, Sutton was formerly the worst, and, all things considered, it is so still. Among separate schools, the worst are Mitcham and Edmonton, the first and fourth respectively upon Mr. Nettleship's black list."

Mr. Nettleship pointed out [2] the ill-effects in the ophthalmic state of Poor Law schools arising from bad ventilation,

[1] *Stephenson, Sydney*, Report on the Ophthalmic State of Poor Law Children in the Metropolis, 1897.

[2] *Nettleship, Edward*, Report on Ophthalmia in the Metropolitan Pauper Schools, 1875.

overcrowding, deficient and defective provision for exercise in the open air, the mixing of infants suffering from ophthalmia with other children, the want of cleanliness in the children's clothes, especially those of the small boys, the use of the same water in washing, the indiscriminate use of towels, improper feeding, and the want of proper superintendence due to the unduly large size of some of the schools.

He advocated the need of adequate cubic space, probation wards, proper means of isolation for those affected, alterations in connection with warming, ventilation, and laundries, the jet system of washing, numbered towels, or the daily supply of clean unnumbered towels, increase in the number of staff and attendants, especially for the infants, grass fields for play-grounds, and changes in dietary.

Mr. Stephenson summarised the recommendations in his Report[1] under the two headings, preventive and curative. He says: "The prevention of ophthalmia demands the improvement from a hygienic point of view of existing schools. Speaking generally, this may be done—

"(1) By breaking up large barrack-line buildings into small detached blocks, and thus reducing the numbers housed beneath a common roof.

"(2) By increasing the allowance of floor and cubic space, and paying attention to the ventilation both of sleeping and living-rooms.

"(3) By taking care that towels are kept separate, and by carrying out the personal ablutions of the children at jets of running water.

"(4) By increasing the facilities for outdoor games and recreations.

"(5) By improving the clothing and diet of the inmates."

He also advocated the provision of small special observation wards, efficient means for disinfection, skilled official inspection of all schools at short intervals, the

[1] *Stephenson, Sydney*, loc. cit.

training of medical officers of schools in the recognition of the various forms of ophthalmia, and the keeping of medical records as to the condition of every child received at a Poor Law school.

As a curative measure, he advocated a properly constructed and equipped isolation hospital school, of the requirements of which he gave an excellent and detailed description.

From the foregoing, it will be seen that two of the chief sources of Trachoma in this country, the army and the Poor Law schools, have been and are being dealt with so as to produce a great decrease in the amount of the disease. It now becomes necessary to refer to a source which is tending to its increase—viz. the importation of aliens into this country from districts where the disease is endemic.

These alien immigrants come mostly from Poland, Finland, Russia, and Armenia, and a considerable number of them are affected with Trachoma. When they start, the ultimate goal of most of them is the United States of America, and the majority of them pass through England *en route*.

The amount of immigration to the United States is steadily increasing;[1] thus in 1889, the number of alien immigrants entering the States was 311,715; in 1900, 448,572; in 1901, 487,918. The number of aliens arriving at ports of the United Kingdom and described as *en route* to places out of the United Kingdom during the first five months of this year (1904) was 38,983.

In 1897 the Treasury Department at Washington, which is directly responsible for the enforcement of the immigration laws into the States, declared Trachoma to be a "dangerous contagious disease," thus putting immigrants affected with it into a class of aliens expressly prohibited from entering the country.

All immigrant aliens arriving at the American ports

[1] *Davis, Dr. A. A.*, The Post-Graduate, May 1902. The Influence Emigration has on the Spread and Increase of Trachoma in the United States.

have, since 1889, had their eyes inspected by the medical officers of the Marine Hospital Service, and if found to have Trachoma, they have been sent back to their port of embarcation at the expense of the shipping company which brought them. Cases of doubtful Trachoma are put into the hospital and retained there, perhaps for three weeks, before a decision is arrived at as to the nature of the affection.

In the first year, 1889,[1] in which these regulations were in force, 300 cases of Trachoma were excluded, a ratio of 1 in 1,000 immigrants. In the second year, 1900, there were also about 300 cases of Trachoma, but the number of immigrants having increased, the ratio was 1 in 1,500. In the third year, 1901, there were 200 suffering from Trachoma, a ratio of 1 in 2,100.

From these figures it is evident that the shipping companies soon became aware of the necessity of instituting an examination of immigrants' eyes before embarking them for the States. The result is that many alien immigrants afflicted with Trachoma, on arriving in England, find they can get no further, and numbers of these poor people now apply at our eye hospitals to be cured of the disease, in order to enable them to continue their journey. This accounts for the large increase in the proportion of Trachoma cases amongst my patients at the Royal London Ophthalmic Hospital in 1903, as shown by the figures given on page xxiv.

The shipping companies are naturally getting very cautious about taking any immigrant who has any discharge from the eyes, for they do not know what may not be called Trachoma on arrival at the American ports. The writer has known them to refuse to take those suffering from conjunctival affections of quite a simple character and nothing like Trachoma, also a patient who had discharge from the eye, the result of a lacrymal obstruction.

In the first three years quite 900 cases of Trachoma were deported from the United States, though not all to this

[1] *Davis, Dr. A. A.*, loc. cit.

country. If, however, to these are added all those aliens whom the shipping companies refused to transmit, it will be seen that it means the accumulation of a large number of fresh cases of Trachoma here—consequently, a large increase in the number of possible sources of contagion.

The subject received some attention from the recent Commission on Alien Immigration, who made in their Report the following incomplete statement on the matter: "It also seems that in consequence of the poor living resulting from poverty there are cases of children amongst the immigrants on arrival suffering from a disease called 'granular ophthalmia.' This disease, under certain conditions, is contagious. It, however, appeared that the disease, which is found in the ranks of poor children generally, did not exist to an exceptional extent amongst the alien children, and no instance was alleged of the disease being communicated by them to others. At the same time, the desirability of permitting people suffering from this contagious disease into the country has to be considered."

In the Aliens Immigration Bill brought before Parliament this year provision was made for the inspecting officers to prohibit the landing of passengers suffering from "any infectious or loathsome diseases," the inspecting officers being required to act in accordance with any general instructions given them by the Secretary of State or by the Local Government Board.

If this Bill, which was withdrawn, had become law, it would have been possible for the Local Government Board to schedule Trachoma as an infectious and loathsome disease, and so secure the country against the importation into it of these sources of contagion.

In considering the way in which those affected with Trachoma enter Great Britain, it must be mentioned that not only do they come from the Continent, but that many migrate here from Ireland.

As has been already stated, a form of ophthalmia, which was probably Trachoma, was very prevalent amongst the

peasantry of Ireland during the eighteenth century. The Irish regiments suffered very severely from it subsequently to the Egyptian campaign at the beginning of the nineteenth century, and on being discharged to their homes spread the disease in their country.

In 1841 most of the workhouses were first established in Ireland, and they soon formed centres for the increase and dissemination of ophthalmia. After the severe famine in 1847-8 these workhouses became overcrowded with inmates; their sanitary appliances and arrangements for ablution were of the most elementary and defective character.[1] Consequently in 1849-50 a severe epidemic of ophthalmia occurred in them.

"By a return obtained from all the Unions in Ireland it appears that in the former year (1849), out of 934,284 persons admitted into and relieved in the workhouse, no less than 13,812 were medically treated for inflammatory disease of the eyes; and in the year 1850 no less than 27,200 were similarly attacked out of 805,702 admitted into the workhouse."[2]

In his examination of the children in the Poor Law schools of London in 1874 Mr. Nettleship was impressed with the large number of those of the Irish race afflicted with granular ophthalmia, and expressed himself as strongly of opinion that they were predisposed to the affection.

From the eye hospitals in several parts of England the writer has heard that many of the cases of Trachoma met with are in Irish immigrants who contracted the disease in their own country.

The great prevalence of Trachoma in New York is largely attributable to the number of Irish who have settled in that city.

The frequency with which the disease is met with in Ireland at the present day is shown by the figures given

[1] *Wilde, W. R.*, London Journal of Medicine, Vol. III. 1851. On the Epidemic Ophthalmia which has prevailed in the Workhouses and Schools of the Tipperary and Athlone Unions.

[2] *Williams, John*, The Ophthalmia of Ireland, 1857.

in the table on page xxiii. The highest proportion of Trachoma cases to other eye patients, there quoted, during recent years in Great Britain is 0·7 per cent., whilst in Dublin it is 2·8 per cent.

It is difficult to prove that the asserted racial predisposition may not in part account for this prevalence of the disease. It is, however, important to recognise that poverty and bad local government, resulting in overcrowding, defective sanitation, and dirty living, have been most potent factors in favouring its spread.

If Trachoma is to be stamped out in Great Britain, strenuous measures will have to be taken to check its spread in the sister isle.

If we turn now from Trachoma, as met with in this country, and consider it from an Imperial standpoint, we are confronted with problems of almost overwhelming magnitude.

For twenty-one years we have had control of the government of Egypt, a country in parts of which it is stated to be quite the exception to find a native who, when the lids are everted, does not show signs of either past or active Trachoma.[1]

As Dr. Boldt has pointed out, there are good reasons for believing that the inhabitants of Egypt were not always afflicted with this disease to the enormous extent which they are to-day. Apparently it was on the decline of the ancient civilisation, and the consequent degeneration of the people, that the affection assumed its pandemic character. With the improved state of government which England has introduced, and the general advance in the well-being of the fellaheen, some cessation of the prevalence of the disease should be expected. To produce any appreciable effect will, however, require prolonged and persistent effort, and the Titanic forces of

[1] *MM. Morax* and *Lakah*, Clinical Investigations on the Etiology of Trachoma in Egypt. Annales d'Oculistique, November 1901.

ingrained habits ignorance, and superstition will have to be encountered.

It is a significant fact that in all Mohammedan countries Trachoma is endemic. The records available do not enable us definitely to determine whether the Arab followers of Mohammed, besides their faith, implanted this disease on the inhabitants of the countries they conquered. There can be no doubt, however, that some of the customs of the followers of the Prophet are most favourable to its dissemination.

Thus the long pilgrimages to holy shrines, such as Mecca and Kerbela, with the overcrowding in pilgrim vessels and filthy caravanserai which they entail, are eminently calculated to spread infection.

In front of all mosques are placed tanks containing water, usually of the foulest description, in which the faithful make their ablutions before entering the sacred precincts. It seems highly probable that the water in these tanks may serve to transmit material of a contagious character.

The methods in the East, moreover, which pertain to cleanliness frequently serve only to add an additional risk of infection. Dr. G. H. Paschayan,[1] of Tauris, some years ago wrote a graphic description of the Persian hammam, the main features of which the writer can corroborate from his own observations. It consists of a large bathing tank, which is filled up as may be necessary from a cistern of heated water, the water reaching up to the bathers' shoulders. In this bath all sorts of people disport themselves, the water becoming thick with the filth from the skins of the numerous individuals who use it, a sediment also of considerable thickness accumulating at the bottom of the tank. A thorough cleansing of the bath, according to Dr. Paschayan, takes place only once in six months.

The risk of disease being conveyed by this highly contaminated water does not seem to occur to the bathers.

[18] *Paschayan, Dr. G. H.*, Archives orientales de Médicine et de Chirurgie, April 1900.

It is interesting, however, to note that though separate times are set apart for the use of the bath by the men and women, when in the seclusion of the anderun a young girl or widow happens to become pregnant, a convenient explanation is afforded by the fact that she has bathed in the same water which had been previously used by the men.

A quotation here from Vambéry's Life and Adventures will not be out of place as giving an idea of Eastern cleanliness. Speaking of the Persians, he says, "My faith in their cleanliness, of which they were so fond of boasting, very soon received a rude shock in witnessing the following scene. In the centre of the yard of the caravanserai, as everywhere else, is placed a basin full of water, originally intended for the performance of ritual lavations; but, as I was watching their proceedings at the basin, I saw that whilst at one side of the reservoir some were washing their dirty things, others placing half-tanned skins into the same water for soaking, and a third was cleansing his baby, there were standing men on the opposite side of the basin gravely performing their religious washings with the identical water, and one of them, who must have been very thirsty indeed, crouched down and eagerly drank of the dark green fluid." Vambéry could not repress a manifestation of loathing at the sight. A Persian, standing near, immediately confronted him and reproved him for his ignorance, asking him if he did not know that, according to the *Sheriat* (the holy law), a quantity of water in excess of a hundred and twenty pints could not become soiled or unclean.

A favourite method of beautification throughout the East is the blackening of the eyelashes with kohl (black antimony). This is applied with a feather, and as often one feather is used for the whole family, another very likely source of infection is created.

Probably, in a country such as Egypt, one of the most frequent ways by which infection is carried is by the fingers. I cannot do better than quote what Mr. Kenneth

Scott,[1] who had an extensive experience of ophthalmic practice in Cairo, has written on this matter. He says that "infection can be traced almost invariably to direct manual contact; finger-tips and thumbs are the ordinary means amongst the lower Egyptian classes of removing surplus discharge from the eyes, and the subsequent handling of articles used in daily work readily transmits this in some form to the hands of others, whence it can be unconsciously introduced to the eye by the not unusual vigorous rubbing of the palpebral fissure."

Speaking of the possible risk of infection being carried by flies, Mr. Scott says: "Flies are ever attracted by a gleaming sticky surface, especially if it is also an odorous one; and as it is the custom never to wash the native babies until two years after their birth, the flies naturally swarm about the faces of these infants, drawn there simply by the glutinous discharge about the eyes and the smell of other filth. Although flies, alighting on infective matter, are capable of carrying it to some other suitable nidus, they seldom, if ever, enter the conjunctival sac of normal eyes."

The influence which climatic conditions in Egypt have in the development of Trachoma has been the subject of much debate. Thus, in the most recent writings, whilst Morax and Lakah,[2] from a study of the disease in Alexandria, arrived at the conclusion that climatic conditions and race exerted no influence, Dr. Alfred Osborne,[3] who has had five years' experience at a large polyclinic in the same town, says that the increase in eye diseases in the hot summer months, from April to August or September, follows a curve approximately like that of all the plagues of Egypt—light, heat, dust, the overflow of the Nile, and flies.

That the climatic conditions alone are not sufficient to

[1] *Scott, Kenneth*, Eye Disease in Egypt. Lancet, Vol. II. 1900, p. 568.

[2] *MM. Morax* and *Lakah*, loc. cit.

[3] *Osborne, Dr., Alfred.* On the Relation of Epidemic Conjunctivitis in Egypt to Climatic Conditions. Archiv fur Augenheilk. Vol. XLIV. No. 2.

produce the disease is shown by the immunity enjoyed by the large European population who observe ordinary cleanly precautions.

Where there is so much to be done in connection with ophthalmia as in Egypt, it becomes difficult to know in what direction to start.

Through the generosity of Sir Ernest Cassel a start has, however, been made. At the beginning of 1903 he placed at the disposal of the Egyptian Government a sum of £40,000,[1] to be used for the benefit of sufferers from diseases of the eye in their country, a special object to be kept in view being the training of native medical men in the diagnosis and treatment of such diseases according to modern methods. The Egyptian Sanitary Department decided to establish a travelling ophthalmic hospital, such hospitals having been originated ten years ago in Russia and proved very successful.

An experimental encampment has been established at Menouf, a town of 23,000 people, about half-way between Cairo and Alexandria, Mr. McCallan, late Senior House Surgeon at the Royal London Ophthalmic Hospital, being appointed surgeon-in-charge. He is assisted by an Egyptian medical man and several native servants who are being trained as sick-orderlies. During the first three months 6,157 patients have been treated and 615 operations performed, 500 of these being extra-ocular, mostly on the eyelids for trichiasis.

Mr. McCallan, with a desire to go to the source of the mischief, inspected a private school at Menouf, the particulars concerning which it will be interesting to quote. The school was for boys aged from six to sixteen years. He found 133 day-pupils, and only 9 of them with normal eyes. Nine children required operation for trichiasis or iridectomy, 8 wanted the lids scraped, 35 were in an infective condition of Trachoma, and no less than 93 of 133 needed eye treatment of various kinds.

[1] Lancet, April 30th, 1904.

Some prophylactic measures against Trachoma are apparently being taken in the Government Schools, but in the private schools nothing is yet being done in this direction.

Perhaps one of the most hopeful measures which has yet been taken is the introduction of a sanitary primer for use in the primary schools of the Egyptian Government.

In India the amount of Trachoma varies considerably in different parts. From conversation with medical missionaries and officers of the Indian Medical Service and Royal Army Medical Corps the writer has ascertained that in the interior, where there is abundant vegetation, very little Trachoma is met with; but that where it is hot, dry, and dusty, and in the large seaport towns, the disease is exceedingly prevalent.

Mr. E. A. Gait, in the Census Report of India for 1901, writes: "The prevalence of blindness is to a great extent determined by climate. It is most frequent in a hot and dry climate, where the glare and dust are highly prejudicial to the eyesight, and is comparatively rare in a cool or damp country, where a profusion of green vegetation rests the eye, and where there is a comparative absence of dust." He goes on to show that, in accordance with these considerations, blindness is most common in dry, hot Patna and Shahabad, less common in the Chota Nagpur plateau, and then follow, *longo intervallo*, Orissa, Central and Eastern Bengal. Though possibly this variable distribution in the amount of blindness may be in part due to a dry, glaring district, predisposing to cataract, it is most likely chiefly due to the greater prevalence of conjunctival affections, and especially Trachoma, in those districts.

In a Review of the Ophthalmic Hospital, Madras, from April 1st, 1881, to December 31st, 1891, Lieut.-Colonel E. F. Drake-Brockman, the then Superintendent, speaking of granular ophthalmia, says, "This disease continues to be very prevalent among all classes, especially among the

Hindus. So long as the insanitary conditions under which these classes live remain unchanged, little can be done in trying to check the spread of the disease. Neoplastic follicular bodies developed in the subconjunctival connective tissue in the eyes of one or two members of a large family, occupying a building unsuitable as to its surroundings and inadequate as to its cubic contents, are certain to be communicated to others who are brought into contact with those affected. I am not exaggerating the case when I state there is hardly a Hindu child in whom, if diligent search is made, these neoplastic bodies may not be found."

Then, after stating that segregation and early remedial measures are absolutely necessary to keep the spread of the disease in check, he says that it contributes a large quota to the causes of extreme defective vision and blindness in the adult population. The figures which he gives seem to show that there has been an increase in the amount of the disease during the period dealt with.

Thus, dividing it into two portions—that during which the old Eye Infirmary was in use from April 1st, 1881, to March, 1886, and that during which the New Ophthalmic Hospital has been opened from April 1st, 1886, to December 31st, 1891—we find in the former period the total number of out-patients was 21,040; the total number of diseases of the conjunctiva amongst these, 6,563 (31·1 per cent.); and the number of granular and chronic ophthalmia cases, 2,275 (10·81 per cent.). In the latter the total number of out-patients was 31,620; the total number of diseases of the conjunctiva, 12,390 (39·1 per cent.); and the number of granular and chronic ophthalmia cases, 4,297 (13·5 per cent.).

The West Indies affords interesting evidence as regards Trachoma, for the large negro population which they contain does not enjoy the immunity from the disease the negroes of the Southern States are supposed to possess.

Dr. F. J. Freeland,[1] the Government Medical Officer, District No. 4, Antigua, states that he has found Trachoma remarkably common amongst the negroes in the West Indies, and that he would for frequency place it second only to catarrhal conjunctivitis. Trachoma, he says, though met with occasionally amongst the whites, does not appear to be nearly so common as amongst the blacks.

In West Africa the inhabitants appear to be remarkably free from Trachoma. Dr. W. Renner,[2] who resides at Sierra Leone, says that at the colonial gaol of Freetown, of which he is the surgeon-in-charge, there is an average of 230 prisoners, who come from the labouring classes of nearly all sections of the heterogeneous tribes which compose the population of the colony and its protectorate, and that there is not a trace of the disease amongst them.

He is also medical officer of the C.M.S. Grammar School, with an average of 200 boys, and of the C.M.S. Annie Walsh Memorial School, with an average of 125 girls. In neither of these institutions has he met with a single case of Trachoma.

Dr. Renner concludes from this that the negroes of the west and south-west coast enjoy an absolute immunity from Trachoma.

Amongst the inmates of prisons in Great Britain, as amongst those of many other institutions, Trachoma, at the first part of last century, was very prevalent.

It is probable that the disease was introduced into Australia by the convicts who were transported at one time in large numbers from this country. In parts of that colony it has found a most congenial soil, and flourishes with a rank luxuriance which recalls that assumed by some species of vegetation when transplanted from the old to

[1] *Freeland, Dr. F. J.*, British Medical Journal, July 1st, 1899, Vol. II. p. 57. Trachoma and Race.

[2] *Renner, D. W.*, British Medical Journal. Sept. 16th, 1899, Vol. II. p. 754. Trachoma and Race.

the new world. A severe mucopurulent form of ophthalmia is also of frequent occurrence, and the two affections, not well differentiated by the inhabitants, are popularly known by the name of "sandy blight."

The circumstances connected with Trachoma in Australia are of interest, because it is found to spread there in the absence of some of the conditions which are its frequent accompaniments in other countries.

For the following facts respecting it I am indebted to Dr. A. H. Bennett, who has practised for eight years at a place called Crystal Brook, in South Australia, which is the centre of a very trachomatous district.

In South Australia, instead of the disease occurring in poorly fed, ill-to-do people, living in overcrowded districts and badly ventilated rooms, it is met with in well-fed, strong, healthy farmers and their families, who are widely scattered over a large area, and reside in roomy, well-ventilated houses.

South Australia is, however, a riverless country. There are creeks which run with fresh water during the winter, but which dry up during the summer months, or convey only water which is brackish and unfit for use.

Each individual farmer has to arrange receptacles for the storage of surface flood water, and the greatest economy in the use of this conserved water has to be exercised to make it last over the rainless summer months.

Where a scarcity of water exists, regular and proper ablutions amongst the inhabitants are sure to be neglected, and the possibilities of the transference of contagious diseases of the eye greatly increased. It is during these summer months, from November to April in South Australia, that these inflammatory diseases of the conjunctiva become so exceedingly common.

The other accompaniments of a hot, dry district which predispose the conjunctiva to infection, and which aid in the introduction of infective matter into it, are also present —viz. frequent dust storms and abundance of flies.

Where Dr. Bennett was practising is situated eight miles distant from what is known as "Goyder's line." It is an imaginary line which has been drawn, dividing the country into two portions. The southern or coast side of the line comprises an area over which a comparatively regular supply of rain falls and which is good for agricultural purposes. The area north of this line has only a precarious rainfall, and though unfit for grain growing will carry sheep. The delineation of the line by Goyder was arrived at by a careful study of the native herbage flourishing under the two different conditions. Dr. Bennett states that he found Trachoma to be twenty times more frequent to the north of Goyder's line than to the south of it.

In New Zealand Trachoma has, up to the present, not spread or attained the same prevalence that it has done in Australia. As evidence against the Maoris as a race enjoying immunity from Trachoma, it may be mentioned that from amongst the native contingent which came to this country in connection with the Coronation festivities, two attended at the Moorfields Hospital affected with the disease. The history they gave was, that one of them contracted it while in Sidney on the voyage to this country, and that the other, who was quartered in the same tent at the Alexandra Palace, caught it from him. A third, also in the same tent, was said to be affected. The same bucket of water was often used for washing by those in this tent, and no precautions were taken about reserving one towel for each man.

For the following interesting particulars respecting Trachoma in Canada I am indebted to Dr. Gordon Byers, of Montreal. He has drawn up for me the accompanying tables showing the ratio of Trachoma cases per thousand eye patients at the Royal Victoria Hospital, Montreal, and the Montreal General Hospital :—

Cases Per 1000
38
37
36
35
34
33
32
31
30
29
28
27
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
1895
1896
1897
1898
1899
1900
1901
1902
1903
Table showing number of cases of Trachoma per 1000 at the ROYAL VICTORIA HOSPITAL from the year 1895 To 1903 inclusive.

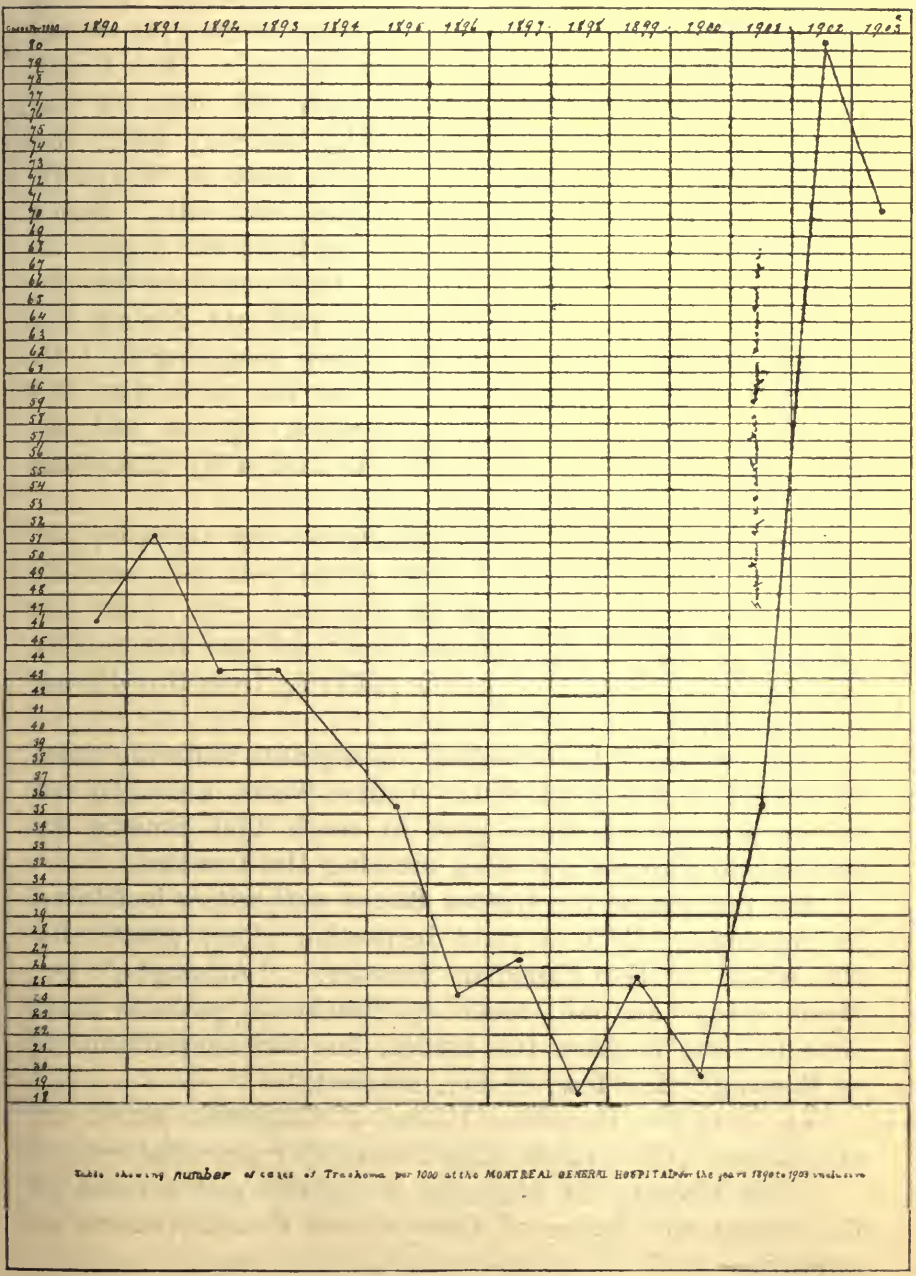

Table showing number of cases of Trachoma per 1000 at the MONTREAL GENERAL HOSPITAL for the years 1890 to 1903 inclusive

The generally higher proportion of Trachoma cases at the Montreal General Hospital is to be accounted for by the difference in situation of the two institutions. The Royal Victoria Hospital is built well up on the slope of the mountain, and draws from a healthy district; while the General Hospital is situated in that part of the city where the foreign element is mostly met with. Strict inspection by the United States authorities began at Montreal in November, 1901, and this accounts for the enormous increase in trachomatous patients during the years 1902 and 1903. The slight drop occurring in both charts in 1903 was probably due to the fact, that the steamship companies and immigration agents had by that time become aware of the inspection by American authorities in Canadian ports.

Dr. Byers adds: "It is notorious that statistics are erroneous, but those that I have given you only confirm what I know positively to be the case—viz. that the exclusion of Trachoma patients from the States has greatly increased the number of people suffering from this disease in Montreal."

The exclusion of intending immigrants suffering from Trachoma at the ports of the United States, naturally led to an attempt on their part to reach that country by booking to Canada and then crossing the frontier.

For this reason the United States authorities instituted in November, 1901, a rigid inspection along practically the whole of the Canadian frontier. "Attempts," Dr. Byers says, "are still made by Trachoma patients from time to time to cross the border, but the surveillance is so thorough that few, if any, succeed."

In 1902 the Canadian House of Commons passed an amendment to the Immigration Act which reads as follows:—

"His Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:—

1. The Immigration Act, chapter lxv. of the Revised

Statutes, is amended by inserting the following sections immediately after section 24:

"24. The Governor-General may, by proclamation or order, whichever he considers most expedient, and whenever he deems it necessary, prohibit the landing in Canada of any immigrant or other passenger who is suffering from any loathsome, dangerous, or infectious disease or malady, whether such immigrant intends to settle in Canada or only intends to pass through Canada to settle in some other country.

"2. Such prohibition may be absolute, or may be accompanied by permission to land for medical treatment only, for a period to be determined as provided by order or proclamation.

"3. Any person landed in Canada from a vessel in contravention of the Immigration Act or any Order in Council or proclamation, may be apprehended without a warrant by any immigration agent or other government officer, and may be compelled to return or be taken on board the vessel. Whoever violates the provision of this Act, or who aids or abets any immigrant or passenger in acting in contravention of such order or proclamation, or who refuses or neglects to take back on board the vessel any such immigrants or passengers, shall incur a penalty not exceeding ten hundred dollars and not less than one hundred dollars in the case of each and every of such immigrants or passengers."

"At first," Dr. Byers says, "the Canadian inspection was of a rather loose character; but I am informed that it is becoming more and more strict. Up to the present time a certain number of the Trachoma patients have been sent back to their homes; but in numerous other instances the patients have been admitted to the Canadian hospitals and allowed to go on their way after a more or less complete recovery from their malady."

As to the amount of Trachoma in other parts of the colony, Dr. Byers, in a paper he read before the Canadian

Medical Association in 1901, said:[1] "I have been informed by medical friends that the disease is comparatively common in certain districts of Manitoba, and even at our hospital the territory from which our trachomatous patients were drawn was extremely broad, our clinics having been visited by patients from the counties of Glengarry (two centres), Stormont, Dundas, Leeds (two centres), Renfrew, Lennox, and Carleton in Ontario; and Brome (two centres), St. Hyacinthe, Missisquoi, Huntingdon, and Ottawa in Quebec."

He also stated that he had it on good authority that the cases of sore eyes among the Doukhobors were probably trachomatous in nature.

Dr. D. N. Maclennan, of Toronto, writes to me that he has met with very few cases of Trachoma since he has been in practice in that city, and that, from inquiries he has made, he believes it is a somewhat rare disease in Ontario. Immigrants for Canada, after landing at Quebec or Montreal, usually, he says, go further West. He testifies to the sharp look-out which is being kept by the Health Officers of the United States border at Niagara.

[1] Canadian Journal of Medicine and Surgery, 1901, p. 349.

CHAPTER I

HISTORY AND EPIDEMIOLOGY

HISTORICAL inquiry into the origin and antiquity of Trachoma is beset with no inconsiderable difficulty. But few records have come down to us from the golden age of medical learning in ancient times, and it is no easy task to correlate the little that has been preserved with modern ideas. To this must be added the fact that much of the scientific progress of classical times was lost in the Middle Ages, during the decline of medical knowledge in general, and of ophthalmology in particular, especially in the latter half of that gloomy period, when medicine had well-nigh lost the character of an inductive science, and the arabianised medicine of the Greeks had become in the hands of Western physicians the sport of scholastic subtleties. "It is, in fact," says Hirsch[1] in his classical History of Ophthalmology, "a sorry task to submit to a critical review the bulky folios—medical compendiums, commentaries, glossaries, etc.—which formed the literary productions of that period, only to find in the end the sterility of the mental exertion—the desert waste of science. Yet in no department of medicine was this wretched state of decay so marked as in that of ophthalmology."

The difficulties attending the study of the history of Trachoma are greatly increased by the inadequacy of diagnostic material in the records preserved, which is

[1] *Hirsch*, Geschichte der Ophthalmologie, Handbuch der gesamten Augenheilkunde von *Graefe* und *Saemisch*, Bd. VII. S. 293.

the less surprising since even at the present time the diagnosis of this obscure disease is still fraught with difficulty, and we are unfortunately still far from a general consensus of opinion in the matter.

In the course of last century, after Trachoma had won historical importance as an epidemic disease of military and civil life, and had made terrible ravages in almost every country in Europe, it was customary to regard *Egypt* as its cradle and historic birthplace. As it was thought possible to find, even in the earliest periods of Egyptian history, extending over several thousands of years, confirmatory references and allusions to it, all discussions on the origin of the disease might be summed up in the sentence: Trachoma is as old as the Nile, the simoom, and the desert.[1] In the oldest historical books of the Bible we look in vain for any confirmation of this idea. When, for example, in Exodus, chap. x., it is stated that Jehovah caused darkness to cover the land of Egypt, this cannot refer to Trachoma infecting the whole population, thereby causing blindness; nor can the disease be reckoned amongst the Plagues of Egypt. On the other hand, we possess evidence seven generations older than this, which proves that more than 3,400 years ago special attention was given to ophthalmology in the Nile district, and that probably Trachoma was recognised and treated. This is the Ebers papyrus,[2] which was written during the height of Egyptian civilisation, a thousand years before Hippocrates, in the eighteenth dynasty, 1553—1550 B.C. The manuscript was discovered by George Ebers during his second journey to Egypt in 1872, in the necropolis of Thebes. It is the oldest book on medicine known. It is a compilation containing only prescriptions for various diseases, including those of the eye. The ophthalmic prescriptions make up about a tenth

[1] *Peltzer*, Die Ophthalmia militaris sive granulosa (aegyptiaca, bellica, contagiosa) vom modernen Standpunkte. Berlin 1870, S. 3.

[2] *Papyrus Ebers*, Das hermetische Buch von den Arzneimitteln der alten Aegypter. Leipzig 1875.

of the whole collection. On translating this highly important discovery, Ebers proved that the Egyptians recognised the condition of "blear eye" or watery eye (*hetae m mrt*); and Hirschberg[1] is of the opinion that the expression means eye affections with considerable secretion, especially the sequelæ of chronic granular conjunctivitis. Accordingly we may assume that Trachoma was probably prevalent in Egypt in those times, yet we cannot conclude that it was spread over the whole population as it is to-day. As Hirschberg[2] writes, "Any one who has seen with his own eyes those wonderful monuments, the Pyramids of the old empire, the rock tombs of the middle empire, the imperial sanctuary, the temples and tombs of Thebes, covered with carvings and inscriptions, of the new empire, or even the ruins from the Renaissance period, and the temples of Denderah, Edfu, and Philæ, from the Ptolemaic and Roman periods, temples adorned from top to bottom, even to the very dungeons, with magnificent carvings and delicate hieroglyphics, cannot readily accept the view that even in the time of the Pharaohs the Egyptians were a blind folk, as the humorous and more cultured Nile dwellers are wont to call themselves to-day. Yet it may and must be admitted that, owing to the constancy of natural conditions, the same diseases may have prevailed in the same environment then as now." Hirschberg, too, like Eble,[3] draws attention to the fact that Egypt in ancient times was a highly cultured country, and its inhabitants, from the equable climate and their own cleanliness, were regarded as a most healthy people. Neither do we find in the old Egyptian literature any proof whatever that Trachoma was pandemic in the Nile district in the time of the Pharaohs, Ptolemies, or

[1] *Hirschberg, J.*, Aegypten, Geschichtliche Studien eines Augenarztes. Leipzig 1890, S. 40.

[2] *Hirschberg*, loc. cit. S. 79.

[3] *Eble, B.*, Die sogenannte kontagiöse oder ägyptische Augenentzündung. Stuttgart 1839, S. 9.

Cæsars, nor in the Greek and Roman literature of classical times, nor in the Arabic writers of the Middle Ages. The name and the idea of an Egyptian ophthalmia was entirely foreign and unknown to the Greek and Roman physicians, although, as we shall see later, they were well acquainted with Trachoma, and described other Egyptian diseases, such as lichen and elephantiasis.[1] Hippocrates (460—377 B.C.) mentions the salubrious climate of Egypt, Herodotus (482—424 B.C.) praises the great cleanliness of the Egyptians, and among the Romans Egypt stood in high repute as a health resort.[1] It was only in the reign of Justinian, after the plague which began in Egypt in 532 A.D., in the Middle Ages, and quite in modern times, up to the middle of the nineteenth century, that the country obtained a bad name from the hygienic point of view. Even since the time of the Byzantines, in the reign of Theodosius the Great (379—395 A.D.), distinct signs of a decline in civilisation appeared, which increased in ruinous fashion under the sway of the Seljukes (1200 A.D.) and Mamelukes (1254—1517), and especially under the misrule of the Turks (since 1517), and manifested itself to a marked degree in the decline in irrigation. Trachoma must have gained footing in Egypt simultaneously, and gradually become endemic and finally pandemic. The latter condition, however, cannot have occurred before the latter part of the Middle Ages, for as Rust[2] emphasises, no mention is made of the disease in the history of the Crusades, nor do the Arabic Egyptian physicians, historians, or geographers allude to it. Even Abdul Latif,[3] a celebrated physician and naturalist, who lived in Cairo about 1200 A.D., and has given an excellent description of Egypt, does not say a single word about Egyptian ophthalmia in speaking of the diseases of the country. Some Hebrew notes of

[1] *Hirschberg*, loc. cit. S. 86.

[2] *Rust*, Die ägyptische Augenentzündung unter der königlich preussischen Besatzung in Mainz. Berlin 1820, S. 143.

[3] *Hirschberg*, loc. cit. S. 99 und 102.

travel by Meshullam ben Menachem (1481) and Obaja (1488) first mention that most of the inhabitants of Egypt were afflicted with eye disease; and about a century later the medical literature of Egyptian ophthalmia begins with the Venetian physician Prosper Alpinus, who practised in Cairo from 1580 to 1584, and found the disease pandemic. So it has continued to rage from that time to the present day, outliving the plague, which disappeared about sixty years ago. We meet with observations on the scourge of Trachoma in most books of travel of the eighteenth and nineteenth centuries down to the most recent times. The term Egyptian ophthalmia for Trachoma first appeared in all European languages after Buonaparte's expedition to Egypt, from which, as we shall see, there dates a new era, pregnant with evil for our continent, in the outbreak and spread of Trachoma.

That Trachoma was also known to the ancient civilised nations—*e.g. India and China*—may well be surmised, but cannot be proved from the sources as yet available. On the other hand, we possess adequate proof that Trachoma was well known and common amongst the *Greeks and Romans*. From various references in the later comedies of Aristophanes (455—387 B.C.) Hirschberg[1] infers that in Athens, owing to the long siege during the Peloponnesian war (431—404 B.C.), the overcrowding of people between the walls, and the growing social misery, Trachoma increased considerably in frequency and severity. In *Plutus* the cure of Trachoma is dealt with at length; in the *Frogs* any one wishing to avoid serving as a marine pleads ophthalmia. The conjecture of Eble[2] that many of the 10,000 Greeks under Xenophon became blind from ophthalmia during the memorable retreat in the year 400 B.C. is not proved; it seems to have been chiefly a question of snow-blindness.

[1] *Hirschberg*, Ueber die körnige Augenentzündung in Ost- und Westpreussen und ihre Bekämpfung. Jena 1897, S. 34.

[2] *Eble*, loc. cit. S. 4.

The treatise περὶ ὄψιος, falsely attributed to Hippocrates, contains the mechanical treatment of Trachoma by friction—the so-called ophthalmoxysis. We find repeated accounts of virulent and contagious ophthalmia. Plato (427—348 B.C.) speaks (*Phædr.* ch. xxxvi.) of sensations for which it is impossible to find an external cause, affecting us in the same manner as ophthalmia caught from other people (οἷον ἀπ' ἄλλου ὀφθαλμίας ἀπολελαυκώς); and Plutarch (50—120 A.D.) calls the contagion of ophthalmia very common and very potent (*Sympos.* v. 7). The contagiousness of ophthalmia is also noted by Ovid and Seneca, and further by Galen, Alexander of Tralles, and Paulus of Ægina.

Throughout the oldest Greek writings we find only the term ophthalmia = lippitudo of Celsus. We meet with the name Trachoma for the first time in Pedanius Dioscorides[1] (60 A.D.); but it only came into general use in the last century, when it was employed in its present specific sense by Rosas in his *Lehre von den Augenkrankheiten*, 1834, then by Hasner, Arlt, and especially by Bendz[2] in 1858. Galen (131—201 A.D.), who practised in Asia Minor, as well as in Egypt and Rome, and whose original treatise on diseases of the eye, like the special work of Hippocrates, is not extant, mentions in numerous places in his genuine writings remedies for Trachoma, which he calls τραχωματικὰ. In the pseudogalenic *Isagoge* four grades or stages of the disease are described—viz. Trachoma, Pachytes, Sycosis, and Tylosis.[3] A similar division is given by Aëtius (540 A.D.). Paulus of Ægina[3] treated Trachoma with a special raspatory (βλεφαρόξυστον).

Among the Romans A. Cornelius Celsus,[3] who lived in Rome in the time of Christ, gives an accurate description of Trachoma, which he calls "aspritudo." In his principal work, *De Medicinâ*, VI. vi. 26, he writes: "Haec autem

[1] *Hirschberg*, Ueber die körnige Augenentzündung, etc. S. 35.
[2] *Hirsch*, loc. cit. S. 427.
[3] *Hirschberg*, Ueber die körnige Augenentzündung, etc. S. 36 ff.

(aspritudo) inflammationen oculorum fere sequitur, interdum major, interdum levior. Nonnunquam etiam ex aspritudine lippitudo fit; ipsa deinde aspritudinem auget, fitque ea in aliis brevis, in aliis longa, et quae vix unquam finiatur."

C. Plinius Secundus uses the term "lippitudo" thirty times in his *Natural History*. An account of Trachoma is also given by Scribonius Largus (43 A.D.), and amongst later writers by Marcellus (380 A.D.) and Cassius (447 A.D.). Hirschberg, to whose valuable work *Geschichtliche Studien eines Augenarztes* we must refer the reader for fuller descriptions and an exhaustive bibliography, comes rightly to the same conclusion as Eble,[1] that Trachoma even in ancient times was a common and familiar disease, not only in Hellas proper, and the coasts of Asia Minor, Sicily, and Lower Italy, but also in the Hellenic empire of the Roman emperors, which embraced the countries bordering on the Mediterranean Sea.

In the Middle Ages the *Arabian* physicians, who otherwise generally imitated the Greeks, independently described pannus, which they called shebel or sebel, *e.g.* Rhazes, Isaac Judæus (died 991 A.D.), who was an oculist in Egypt, and Avicenna (died 1037 A.D.). They confused Trachoma with Psorophthalmia (lid-itch), by which the ancient Greeks understood an irritating, burning exfoliation at the lid margins and canthi. The knowledge of Trachoma was thus confused and obscured by the Arabs.

European writers in the Middle Ages copied from the Arabs, but they have described Trachoma so vaguely that we can only make a conjecture as to its occurrence in Southern and Central Europe at that time.

Benvenutus Graphæus, who worked as an oculist in the East and West in the thirteenth century A.D., states that the disease was much more prevalent in the East. He mentions excision of the granulations, as well as friction with fig leaves. Guy de Chauliac (1300—1368) gives a recognisable description of Trachoma.

[1] *Eble*, loc. cit. S. 75.

In more modern times Trachoma (asperitudo) is mentioned without description by Ambroise Paré (born 1517), pannus by Pierre Franco (1561), who under the influence of the Arabs speaks of Trachoma as "la rogne des yeux" (eye itch), and both Trachoma and pannus by George Bartisch, the author of the first German book on ophthalmology (*οφθαλμουδολεία*, or *The Service* [*or Treatment*] *of the Eye*, Dresden, 1583). We further meet with allusions or descriptions by St. Yves (Paris, 1722) and his contemporary Maître-Jean, who speak of "dartre des paupières" (lid scabs or herpes).

Observations of a similar kind are met with in Spain and Portugal in Amatus Lusitanus, and in Holland in Forestus.[1] We may also include here the eye disease described by the English physicians of the eighteenth century under the name "mulberry eyelid," as well as the epidemics of ophthalmia that raged in 1699—1701 in Breslau, in 1761-2 among the English troops in Westphalia, and those on the Lower Rhine from time immemorial, but especially in 1799.

A widespread epidemic of ophthalmia was observed by Jacob Penada[2] at Padua in 1788. Joseph Beer describes Trachoma, with an illustration, in his *Lehre von den Augenkrankheiten* (1792), and in 1813 he speaks also of its sequelæ, the distortion of the lids and trichiasis.

We come now to Napoleon's expeditions, when Trachoma spread with a contagion and virulence, such as had never been witnessed in the history of the world. The Prussian Medical Director-General, Carl Ferdinand Graefe,[3] writes in this strain in 1823: "The ravaging eye-scourge of our time wrought fearful havoc amongst the armies and populace throughout almost the whole of Europe, and even the New World. Thousands lost their sight, large hospitals were devoted to eye patients, and public asylums were erected for

[1] *Haeser*, Geschichte der epidemischen Krankheiten. Jena 1865, S. 675.

[2] *Eble*, loc. cit. S. 20.

[3] *Graefe, C. F.*, Die epidemisch-kontagiöse Augenblennorrhoe Aegyptens in den europäischen Befreiungsheeren. Berlin 1823, Preface.

the blind. Considerable sums of money were spent in stamping out the disease. In no country, in no town, did it entirely disappear; on every side it periodically broke out afresh, on every side its recurrence is still to be dreaded." Similar accounts are to be found in most of the very numerous writers of the time.

As is well known, Napoleon Buonaparte, under the mask of an expedition against England, set sail from Toulon on May 19th, 1798, with an army of 35,000 men in 300 transports, besides 13 men-of-war and 8 frigates. He occupied Malta on June 12th, and landed in Egypt on July 1st—*i.e.* at the season when epidemic ophthalmia in Egypt is at its height. After seizing Alexandria on July 2nd, defeating the Mamelukes in the battle of the Pyramids on the 21st, and taking Cairo on the 22nd, his victorious troops were opposed by a far more dangerous foe than they had yet encountered—disease. It had sprung up gradually and almost imperceptibly, as if out of the ground of the conquered country, and had already grown to fearful dimensions. It took the form of the usual military epidemics—plague, dysentery, scurvy, yellow fever, hepatitis, leprosy, sunstroke, and Trachoma.[1] 1,689 men died of plague, and amongst them 40 surgeons, 2,468 of dysentery, 3,500 were attacked with scurvy, of whom 272 died, and the army suffered great losses from sunstroke in the Libyan desert; but Trachoma, the Egyptian ophthalmia, was especially fatal to their efficiency as a fighting force. As early as 1798 a great part of the French army was attacked, though in a comparatively mild form. After Buonaparte had left the ill-fated seat of war in August, 1799, in 1800, when the greater part of the army was away from the coast, and less exposed to hardship, the ophthalmia disappeared almost entirely. With the spring of 1801, however, when the troops moved towards Alexandria to drive back the English, who had landed, the disease began to spread again. In 2½ months 3,000 men

[1] *v. Linstow*, Deutsche militärärztliche Zeitschrift 1900, S. 203.

were attacked,[1] and in a short time two-thirds of the French troops fell victims.[2] The epidemic now continued to rage almost universally and uninterruptedly during the whole of the army's sojourn in Egypt up to August, 1801. Those who suffered most severely were the regiments stationed along the banks of the Nile, those who remained in the Delta, the Division Desaix, which patrolled the Nile in boats in Upper Egypt, and particularly the sappers, to whom the duty fell to build pontoon bridges between Gizeh and the island of Raoudah. Besides these, many of the wounded that lay in the hospitals in Cairo suffered more from their eyes than from the wounds which they had received. Special eye-hospitals had to be erected in Cairo, Gizeh, and Rosetta. The epidemic abated only in August, 1801, when the remainder of the French army, still numbering 13,000 men, were conveyed back to France in English vessels. Many of the patients made considerable progress during the voyage. According to Larrey, who had regarded the disease as merely "an epidemic catarrhal flux," it ceased to be epidemic soon after their return, and during the following years of war, from 1801 to 1816, it is admitted by all the writers of the period that it occurred only sporadically, and in no such virulent form as afterwards in other armies. The number that became blind is not recorded. Moreover, the disease is said to have spread very little amongst the civil population of France.

These accounts, derived from French physicians, were received by contemporaries in other countries with some suspicion. Many like Eble[3] and Jäger,[4] inclined to the opinion that the principal reason why the French army surgeons had not diagnosed the disease correctly was due to the decline of ophthalmology in France at that time. On

[1] *Assalini*, Observations sur la peste et l'ophthalmie d'Égypte. 1816, S. 103-5.
[2] *Larrey*, Mémoires du Chirurgie militaire—I. S. 203-5.
[3] *Eble*, loc. cit. S. 78.
[4] *Jäger, F.*, Die ägyptische Augenentzündung (Ophthalmia aegyptiaca). Wien 1840, S. 8 f.

the other hand, we must accept it as a fact, quite authenticated, though as yet inadequately explained, that the French army which returned from Egypt suffered relatively little from Trachoma in the following years during which the war lasted. If the disease had been even approximately as contagious as it was subsequently in the armies of England, Italy, Prussia, and other nations, it must necessarily have been noticed.

The *English* troops under Abercrombie, which landed at Aboukir, in Egypt, in 1800, were almost all attacked by Trachoma, so that several large special eye-hospitals had to be erected.[1] English physicians were undeniably the first to draw attention to the fact that Egyptian ophthalmia is contagious and produces quite specific tissue changes in the conjunctiva, and that the conjunctiva of the lids comes much to resemble the villi of the small intestine in colour and granular appearance. Vetch[2] in particular, in 1807, gave typical pictures of the granulations.

After the evacuation of Egypt in 1803, the English army was disbanded, and spread the disease broadcast. Wherever the troops touched—Malta, Sicily, Gibraltar, Portugal, Spain—Trachoma appeared with more or less intensity. In Great Britain itself it broke out furiously, first amongst the Irish regiments, which infected the 2nd battalion of the 52nd, thus transferring it to England in 1804. Ultimately it spread over nearly every division of the army. The battalion mentioned, consisting of 700 men, had 636 Trachoma patients requiring hospital treatment in one year (1805-6).[3] Of these 50 lost both eyes, and 40 one. In 1818 the blind amongst the English patients numbered over 5,000, so that the Government voted £100,000 per annum for their support.[4]

[1] *Eble*, loc. cit. S. 28 f.

[2] *Vetch*, Geschichte der Ophthalmie, welche in England nach der Rückkehr der brittischen Armee herrschte. Aus dem Englischen übersetzt von *Michaelis*. Berlin 1817.

[3] *Vetch*, loc. cit. S. 4 ff.

[4] *Graefe*, loc. cit. S. 64.

The civil population naturally soon became infected to a considerable degree. The disease first showed itself in the brothels most frequented by the soldiers; it afterwards appeared throughout the country, but most disastrously in public institutions, foundling hospitals, and infirmaries. From 1802 to 1810 alone, 2,317 men blinded by Trachoma were discharged from Kilmainham and Chelsea Hospitals. The Military Asylum, an institution intended for 1,400 orphans, had up to the year 1811 no fewer than 1,500 cases of Egyptian ophthalmia.[1]

As regards *Italy*, there can be no doubt that the disease broke out among the Italian soldiers at Elba and Leghorn shortly after the French troops from Egypt landed there in 1801.[2] From there it spread first along the coast of the Tyrrhenian Sea to Chiavari and Genoa, and during 1804 to 1810 inland to Parma, Mantua, Padua, Vicenza, Cremona, Lodi, and Milan. Trachoma raged for seven years amongst the 6th Italian regiment, who had caught it in Elba. It was only after they returned from the Spanish campaign, and went to Ancona in 1811,[3] that the epidemic spread along the Adriatic coast. Within a few weeks after the arrival of the regiment in that town the malady became prevalent amongst the prostitutes, and also attacked some of the citizens. From that time it grew in severity and extent, speading along the coast to Sinigaglia and Rimini, and subsequently inland to Loreto and Macerata, and even as far as Ascoli. In 1813 it seems to have reached its climax. In Ancona in 1812, of 1,500 soldiers affected, 97 lost one eye and 49 both; whilst in 1813, 40 other cases lost one eye and 25 both. It was a striking fact that the infantry suffered more than the cavalry, and the recruits most of all. It is reasonable to think that the recruits, coming from infected districts, contributed materially to the

[1] *Graefe*, loc. cit. S. 64.

[2] *Omodei*, Abhandlung über die ägyptische ansteckende Augenentzündung und ihre Verbreitung in Italien. Aus dem Ital. übers. von *E. Wolf*. Frankfurt a. M. 1820, S. 47 ff.

[3] *Eble*, loc. cit. S. 27.

spread of the disease; it cannot therefore, as Omodei[1] asserts, be put down entirely to the Egyptian campaign. Moreover other authors, such as Assalini, Penada, Quadri, Rubini, and Cobla have proved that similar eye affections were prevalent among the troops in Modena as early as 1792, and among the civil population even before the return of the Italian contingent of the French army, *e.g.* in 1804, 1809, and 1810 in Padua, and in 1810 in Pavia.[2]

We may mention here the outbreak of ophthalmia in 1809 among the Italian troops stationed in Hungary. Even in 1817 to 1824 the disease broke out repeatedly in the military hospital at Leghorn. Moreover, a very serious epidemic occurred among the Neapolitan garrison at Palermo and Catania between 1822 and 1826. The Austrian garrison at Palermo, which was strictly isolated, remained perfectly free.

Although, therefore, Trachoma was well known in Europe before Napoleon's time, yet its extraordinary dissemination in the French, English, and Italian armies must undoubtedly be attributed in great measure to their infection in Egypt. On the other hand, there is no doubt that the armies of other European nations remained almost entirely free from Egyptian ophthalmia, in spite of their frequent intercourse with the French troops.[3] Good examples are found in the Austrian army, which was often engaged with the French from 1799 to 1809, and in the Prussian army up to 1813, which fought with a Russian army against the French in 1806-7.

These incontestable facts refute the view which finds wide acceptance even at the present day, that the transmission of Trachoma into every army and country in Europe was entirely the result of infection from the French

[1] *Omodei*, loc. cit. S. 95 f.

[2] *Haeser*, loc. cit. S. 678.

[3] *Baltz*, Ueber die Entstehung, Beschaffenheit und zweckmässigste Behandlung der Augenentzündung, welche seit mehreren Jahren unter den Soldaten einiger europäischer Armeen geherrscht hat. 1822, S. 69.

army in Egypt. The latter, on the contrary, as has been remarked, did not suffer to any appreciable extent after its return from Egypt, and within the next ten years it marched through almost the whole of Europe without producing demonstrable epidemics of Trachoma anywhere.[1]

"Never within the memory of man," writes the Austrian regimental surgeon Burkart Eble in 1839, "was any army, even the French in Egypt, so terribly ravaged by this disease as the Prussian army during the years from 1813 to 1820."

In the *Prussian* kingdom all able-bodied men and youths had been summoned to arms by general proclamation in the spring of 1813. With unprecedented enthusiasm young and old of all classes obeyed the king's summons, and flocked to the places of rendezvous. These were situated in those provinces which had been first evacuated by the remnants of the enemy's army that had fled out of Russia—East and West Prussia, and Silesia near Königsberg, Dantzic, and Breslau.

Here Trachoma first manifested itself in the Prussian army,[2] particularly among the recruits, the militia, and the Duke of York's army corps. The latter had been on the left wing of the French force that was operating against Russia, though it had not come into close contact with it. It had been stationed for months in the Baltic provinces, which belong now to the great Trachoma tract of Central Europe, extending north to the Gulf of Finland, and south through Galicia to the Carpathians. Since even the most recent researches of Ebstein[3] contain only an account of snow-blindness and severe conjunctivitis due to cold, but nothing about Trachoma in the great French army of 1812, we must regard it as certain that the Prussian army was infected, not by trachomatous French soldiers, but partly by Trachoma which was endemic in the Russian and

[1] *Eble*, loc. cit. S. 41.

[2] *Baltz*, loc. cit. S. 54 f.

[3] *Ebstein, W.*, Die Krankheiten im Feldzuge gegen Russland (1812). Stuttgart 1902, S. 40 f.

Prussian Baltic provinces then as now, and partly through the enrolment of many trachomatous recruits and militia men. The author hopes in a subsequent work to bring forward irrefutable proofs in support of this view, and only mentions here that A. Roth [1] expresses the same opinion in his excellent work *Die Krankheiten des Sehorgans*. Hirschberg [2] too is of the opinion that in Russia proper, in the Baltic provinces, and perhaps also in the Prussian provinces, the disease was endemic before the French invasion, for we find popular remedies for Trachoma mentioned in the theses of that period at the Dorpat University. He points out further that until compulsory education and universal conscription were introduced, this chronic granular complaint need not have made any great stir, especially amongst an agricultural population. The correctness of this opinion has been confirmed in the last decade, for it was only through special investigations by the Prussian Government that Trachoma was found to be endemic in the eastern provinces to an extent previously unsuspected.

Starting from the great military centres Königsberg, Dantzic, and Breslau, ophthalmia appeared [3] under circumstances which completely exclude derivation of the disease from Egyptian contagion.[4] At first it occurred in a mild form; after the battle of Waterloo it spread to an alarming extent, but disappeared again almost entirely after the conclusion of peace in 1816.

In 1818 ophthalmia again broke out with great virulence and extraordinary contagiousness, involving a third of the troops. It started in the Prussian garrison at Mainz, in the 34th regiment of Infantry, which had not long before arrived from Silesia. Again it chiefly attacked recruits

[1] *Roth, A.*, Die Krankheiten des Sehorgans. Handbuch der Militärkrankheiten von Düms. Bd. III. S. 197 f.

[2] *Hirschberg*, Ueber die Körnerkrankheit in Ost- und Westpreussen. Sonderabdruck 1897, S. 5.

[3] *Eble*, loc. cit. S. 41.

[4] *Baltz*, loc. cit. S. 55.

and reserves from the Lower Rhine and Nassau, without spreading to the Austrian garrison. This epidemic may be positively attributed to infection by endemic Trachoma—*i.e.* to enrolment of trachomatous recruits. Indeed, long before the Napoleonic wars so-called "weak eyes" (according to Jüngken nothing else than granulations) were exceedingly common amongst the agricultural and poorer classes in the Rhine country.[1] The total number of cases of Trachoma in the Prussian army between 1813 and 1821 amounted to 25,000[2]; those totally or partially blinded to at least 1,100.[3]

The *Austrian* army remained perfectly free from ophthalmia throughout the whole of the campaign, in spite of the fact that it repeatedly came into close touch with the French troops during the years 1799—1809. It was only after 1816 that three serious epidemics occurred.[4]

Two of these were in the garrison of Klagenfurt in Carinthia. The first broke out in the Baron von Wimpffen Infantry Regiment No. 13, which was formed in 1814 from the remnants of the former Franco-Italian 1st, 2nd, 4th, and 6th Light Infantry. Among these soldiers were men who had gone through the Egyptian campaign, or had afterwards had the disease in Italy, Spain, or Sicily, as well as others who can be proved to have been enrolled as recruits whilst their eyes were affected.[5] This epidemic lasted with varying intensity until 1823, and resulted in about 1,300 cases of Trachoma, of whom nearly 80 were rendered partially or totally blind.

The second and milder epidemic in 1833-4 attacked the Lattermann Infantry No. 7 in Klagenfurt, and the Peterwardein Borderers, affecting 920 men, of whom only 2

[1] *Jüngken*, Ueber die Augenkrankheit, welche in der Belgischen Armee herrscht. Berlin 1834, S. 5.

[2] *Graefe*, loc. cit. S. 67.

[3] *Niedner*, Die Kriegsepidemieen des 19. Jahrhunderts und ihre Bekämpfung. Berlin 1903, S. 166.

[4] *Hoor*, Prophylaxe und Beseitigung des Trachoms in der K. u. K. österreichisch-ungarischen Armee. Wien 1893, S. 10.

[5] *Eble*, loc. cit. S. 36.

partially lost their sight. Professor Friedrich Jäger[1] discovered in one company a man, Private Michel Miluwitsch, who was long known to have had bad eyes, spending his time between the hospital and his company. He was suffering at that time from chronic Trachoma, and Jäger thinks, probably correctly, that he was the origin of the epidemic, first infecting the subdivision to which he belonged, thus producing sources of contagion which soon communicated the disease to the whole body of troops. Truly a classical example of the method of spreading Trachoma!

The third epidemic occurred at Florence between 1849 and 1851; its victims numbered 2,212, of whom 26 lost both eyes, and 24 one.[2]

Since that time Trachoma has appeared not only in the army, but also in such widespread endemic form in the Austria-Hungarian Empire that great difficulties are experienced in obtaining recruits.[3]

The *Russian* army also escaped Trachoma during the Napoleonic wars. It was not until 1818 that it appeared in the garrison at Warsaw,[4] and afterwards, between 1821 and 1823, to a slight extent at Cronstadt, Oranienbaum, and St. Petersburg. During the Russo-Polish war of 1831 it acquired considerable proportions, and appears from that time to have remained endemic in the army. According to Fuchs, the grand total of those who suffered from it up to the year 1839 was 76,811, of whom 878 were blinded in one eye, and 654 in both. In the Crimean war, too, the disease played a part, chiefly in January, 1854, amongst the French and British troops in the trenches at Gallipoli.[5] Lastly, during the Russo-Turkish war of 1877-8 it was the cause of four-fifths of the men being rendered blind.[6]

[1] *Jäger*, loc. cit. S. 51.

[2] *Wotypka*, Die kontagiöse Bindehaut-Entzündung (Conjunctivitis contagiosa). Wien 1852, Vorrede S. XIII.

[3] *Hoor*, loc. cit. S. 11.

[4] *Tschetirkin*, Ueber die Augenkrankheit, welche in der Kaiserlich-Russischen aktiven Armee herrscht. Aus dem Russ übers. von *Magaziner*. Kalisch 1835.

[5] *Myrdacz*, Sanitätsgeschichte des Krimkrieges. Wien 1896, S. 9.

[6] *Cohn*, Lehrbuch der Hygiene des Auges. Wien und Leipzig 1892, S. 115.

In the *Dutch* and *Belgian* armies ophthalmia broke out with great virulence as early as 1815-25, spreading at the same time among the civil population on the Lower Rhine; but it was worse after 1834. According to Jüngken,[1] who was summoned from Berlin to Brussels with the object of stamping out the scourge, 4,000 men were totally and 10,000 partially blinded in the Belgian army up to 1834 alone. Vleminckx, the chief of the Belgian Sanitary Staff, gives the number of blind from 1830 to 1836 as only 695, whilst those who had lost one eye were at most 600.[2] He considered that the chief cause of the terrible prevalence of the disease was the drafting of a large number of soldiers, affected with granulations, from the old Dutch army into the new Belgian one; and, as an additional cause, the unhealthy uniform, of which a fuller account will be given later. Vleminckx denied the contagiousness of the disease, and attributed it to the pressure of the shako and the newly introduced collar; hence more than 4,000 trachomatous patients were, on Jüngken's advice, discharged to their homes in 1834. The army was thus cleared of the disease at one stroke, but it gained a footing in the country among numberless families which had never known it before. By this brilliant but disastrous experiment the last trace of doubt as to the contagiousness of Trachoma was dispelled. It was obvious that further measures had to be taken; a searching examination of the troops was instituted, and those affected with Trachoma were sent into special hospitals, after which the disease gradually diminished.

Eble[3] considers it probable that the *Swedish* army, which often came into contact with the Prussian from 1813 to 1815, was affected in that manner. At any rate, the reports of the hospital of the 1st Swedish Army Corps at Friedrichstadt in 1814 mention a contagious

[1] *Jüngken* (loc. cit. S. 3 und 5) states that granulations—so-called "soft eyes"—were very common amongst the civil population on the Lower Rhine before the Napoleonic period.

[2] *Eble*, loc. cit. S. 58.

[3] *Eble*, loc. cit. S. 49.

ophthalmia which prevailed among the troops returning from Germany.

In the garrison at Stockholm an epidemic form of ophthalmia appeared in October, 1814; it was introduced by 500 marines of the coasting flotilla that had returned from Norway. This fleet was employed for the transport of the Swedish army from Germany home, and it was then that the sailors are supposed to have become infected. According to Widmark's researches,[1] however, Trachoma was endemic in Sweden before that time. It was certainly described as an endemic disease in Finland even in the eighteenth century.

In the *Danish* army Trachoma, according to Bendz,[2] was unknown until 1848, when it was caught from the German troops, and spread widely over the country. In 1848, in Copenhagen, 1,156 out of 6,171 men (18·8 per cent.) were affected.

In the *Portuguese* army 10,000 men were attacked between 1849 and 1859; of these 55 became blind.[3]

There are a few conclusions which may be drawn from this historical survey. From the descriptions of the disease given by the authors during the first decade of last century, there can be no doubt that Egyptian Ophthalmia included not only the Trachoma of the present time, but several quite different diseases, such as simple catarrh, follicular swelling and follicular catarrh,[4] blennorrhœa.

In the light of modern views it does not seem surprising that military ophthalmia should play so important a part as a plague both in peace and war. We see how its origin and spread depended almost entirely upon the extent to which it was endemic among the population at the seat of

[1] *Widmark*, Zehenders Klin. Monatsblätter f. Augenheilkunde 1894, S. 209.

[2] *Bendz*, Quelques considérations sur la nature de l'ophthalmie militaire en Danemark. 1858, S. 17.

[3] *Cohn*, loc. cit. S. 113.

[4] *Löffler*, Zeitschr. f. Erfahrungsheilkunde 1849, S. 301 ff., considers, for example, simple follicular swelling to be the first stage of Trachoma, and he calls the follicles primary or fundamental granulations.

war. When it had once gained a firm footing in a body of troops, it was very difficult to eradicate it. Moreover, the modern arrangement of a standing army and auxiliary forces promoted to an enormous degree the reciprocal transmission of the disease between soldiers and civilians, whilst the rapid movements of troops and the frequent concentration of huge bodies into a small space facilitated its spread exceedingly. It was very considerably aided, too, by the fact that its contagious character was often denied, so that very simple precautions for its prevention did not suffice. When it had once become an army plague, it exerted, as we shall see, a very considerable influence upon the death-rate in times of peace during the whole of last century. Even in the present day it is in some armies a troublesome scourge which is rooted out with great difficulty.

CHAPTER II

GEOGRAPHICAL DISTRIBUTION

In the last chapter we discussed Trachoma as a disease which had raged from time immemorial in various districts and countries, in endemic or pandemic form. We further showed that it attracted general attention only by its ravages since the beginning of last century amongst the armies and civil populations of European nations. It will now be of scientific as well as practical interest to make clear the present geographical distribution of the disease.

Speaking generally, one may say that after the first half of last century Trachoma diminished in extent throughout the continent. During the Napoleonic wars greater bodies of men had been marched up and down, and cast hither and thither throughout Europe, than at any time since the migration of nations and the Crusades. Hence Trachoma had found in the army a suitable nidus in which to develop. Under the influence of concentration in badly ventilated and filthy buildings, the countless insanitary conditions of a campaign, its many hardships and irregularities of life, combined with the very lowest level of hygiene at that period, the disease had grown with frightful virulence, baffling all the efforts of the surgeons, and hindering and paralysing strategic movements.

For a long time Trachoma was erroneously held to be a disease peculiar to soldiers, from which the civil population was exempt; hence it was called "Ophthalmia militaris." Even as late as 1859 the Belgian Academy of Medicine[1] thought it necessary to publish the following

[1] *Prager*, Med. Jahrb. Bd. III. S. 279.

statement: "There is no such disease as Ophthalmia militaris in so far as that term is meant to denote a specific eye affection exclusively found among soldiers."

In the long period of peace following the European wars of liberation, in which armies were reduced in size and more attention was devoted to the claims of hygiene, Trachoma gradually lost much of its virulence. It appeared more and more in the chronic form with which we are almost exclusively familiar to-day, and it began to become more and more confined to certain localities. After the experience of the wars it was studied by numerous surgeons, and its nature became better understood; but as there was still much obscure, in spite of all investigations, an enormous literature sprang into being on the subject. After heated discussions and bitter controversies as to its ætiology had gone on for years, and many books had been written on its treatment and prophylaxis, special interest has been more recently aroused in the question of its geographical distribution. This was treated in a thorough and systematic manner for the first time in 1897 at the Eighth International Congress for Hygiene and Demography held at Budapest. Though we have not advanced so far as to be able to draw an exact map of the distribution of Trachoma, yet so many accounts have been published from all parts of the world, that we have acquired very accurate knowledge in the case of some countries, and we have at least a general survey of most others.

It is a peculiarity of this disease that it develops nowadays extremely slowly and almost imperceptibly, so that it is very difficult to draw up reliable statistics. Since a vast number of Trachoma patients never come under medical treatment, proper statistics could only be obtained by the examination of the whole population in the trachomatous districts. Such exhaustive investigations have naturally been carried out only in exceptional cases. In by far the majority one has to be satisfied with relative figures—*i.e.* with the approximate estimate of such patients

as have undergone medical treatment compared with the total number of eye patients. By compiling as many reports as possible from public ophthalmic hospitals and private ophthalmic surgeons of any given district, province, or country, an approximate picture of the geographical distribution of Trachoma can be obtained. At the same time, the still prevalent uncertainty in diagnosis is very frequently a disturbing factor and source of many errors; moreover, patients attending different surgeons are liable to be counted twice, and strangers to the district are not sufficiently differentiated.

Statistics of this kind have been compiled by various authors. In 1861 C. Weiss published at Dorpat a thesis on *The Statistics and Ætiology of the most common Diseases of the Eye in Livonia, with special reference to Trachoma.* Here, with the aid of a map, he described the distribution of Trachoma in the several districts of the Russian Baltic provinces. In 1879 F. Falk wrote a larger work, *On the Geographical Distribution of some Diseases of the Eye.* These were followed by the publication of numerous statistics.

The latest inquiry, embracing the whole German Empire and neighbouring countries, emanates from Hirschberg,[1] who has rendered very valuable services to the subject. On practical grounds he distinguishes four grades: (1) Trachoma-free, when the native population yields less than 1 to 2 per thousand cases of Trachoma in all the eye patients attending a particular hospital; (2) slightly infected, when the number amounts to 10 to 15 per thousand; (3) moderately infected, up to 50 per thousand; (4) seriously infected, beyond that number.

From our present knowledge we must admit that Trachoma extends more or less over the whole world, and may be thus in a certain sense regarded as a "universal disease."[2] Although there are areas that are absolutely

[1] *Hirschberg*, Deutsche mediz. Wochenschr. 1897, No. 27 ff.
[2] Zentralbl. f. prakt. Augenheilk. 1901, S. 398.

free from Trachoma, we nevertheless find it sporadically in every country, in many as an endemic disease, impairing the working capacity of the people and the fighting power of the State, ruining the life and happiness of whole families, and very decidedly influencing the number of blind. In some countries it has gained footing as a pandemic plague, apparently long beyond possibility of eradication. In order to be able to understand this fully, we must briefly review the nature and mode of propagation of Trachoma.

Trachoma of the present day, as we shall explain more fully later, is an exceedingly chronic disease, contagious at certain stages, and lasting for months, years, or even decades—a disease which, when left to itself, may disappear in a certain number of cases without causing any great damage, but in most cases leads to serious and permanent injury to sight, and frequently to complete blindness. In former times it was pre-eminently a disease of the army and of soldiers, as the much-used term "ophthalmia militaris" shows. We now know, however, that the standing armies originally derive their Trachoma from the infected civil population in the areas from which recruits are drawn, only to give it back again to the people, often with interest, when men are discharged who have served their time or become incapacitated. Thus, as regards Trachoma, there exists between soldiers and civilians a very close relationship, which is increased to an extreme degree by billeting, manœuvres, and especially the unhealthy conditions of life during war.

All experts are agreed that the endemic form appears chiefly and primarily as a disease of families, extending very slowly and gradually among the resident population by direct contagion through the discharge, as *e.g.* in Livonia, from one farm to the next. Fostered by ignorance, filth, poverty, and social misery, Trachoma is to-day essentially a disease of the poor, amongst whom it slowly and imperceptibly gains ground. In its earliest stages of

development in the lower classes it is little heeded, on account of the relatively slight inconvenience caused by it, and it is often borne with a stupid kind of fatalism, until sight is irretrievably lost. We then see it gradually through years and decades gaining hold over vast territories, and assuming the nature of a plague, whilst the people remain all unconscious. Even in higher social circles, and among the authorities in places where compulsory education and universal conscription do not direct attention to it, it is still not regarded as the plague that it is. By this time the opportunity for effective prevention is long past, and due treatment of the endemic disease is surrounded by well-nigh insuperable difficulties.

Further, we see the disease secretly and very slowly developing amongst the lowest classes, creeping quietly and continuously onwards, but speading rapidly in endemic or epidemic form wherever great multitudes are crowded together and direct contact frequently occurs, *e.g.* in boarding-schools, workhouses, barracks, camps, and occasionally in ordinary schools. We see too, especially in this age of commerce, how the disease starts in endemic foci and spreads to unaffected areas along the channels of commercial intercourse, taking the form of a veritable trade disease, and in a certain measure retaining its migratory character. Thus, though altitude, geological and climatic conditions, individual and racial idiosyncrasy, occupation, etc., may exert a certain influence, Trachoma may finally gain a firm footing everywhere.

If now, with the statistics before us, we consider first the *German Empire*, we find localities in the east and north-east affected with endemic Trachoma of the worst description.

Widespread and endemic as Trachoma probably has been from time immemorial in the western provinces of Russia, especially in Poland and the Russian Baltic provinces, it is continually being brought over the border into Prussia[1]

[1] *Hoppe*, Zentralbl. f. prakt. Augenheilk. 1898, S. 7.

along the trade routes, and may have existed there for centuries. A more accurate numerical knowledge of Trachoma in the eastern German provinces has been acquired only in recent times (since 1897) by the systematic examination of schools.[1] Until then opinion had to be formed on general grounds. Some data were also obtained from the results of recruiting, for by the regulations issued in 1880 and 1893, all persons with well-marked Trachoma are rejected or discharged.

The reports from all the Government districts of Prussia prove that epidemic Trachoma prevails chiefly in East and West Prussia, in Posen, and in the border districts of Silesia. According to Kirchner,[2] the areas most affected in East Prussia are Johannisburg, Sensburg, Insterburg, Pillkallen, Lyck, Tilsit, Heydekrug, Ragnit; in West Prussia, Konitz and Strasburg; in Silesia, the Government district of Oppeln; in Posen, chiefly Neutomischel, Jarotschin, East Posen, Kosten, and Schildburg. The disease prevails everywhere, chiefly among the lower classes, and finds in the raw climate, the low grade of civilisation, the wretched domestic conditions and miserable dwellings, as well as in alcohol, its support and predisposing cause. In Posen [3] it is the rule among the lower classes for the whole family to live in a single room of the smallest possible dimensions, which serves for kitchen, washhouse, storeroom, and bedroom all in one; moreover pigs and poultry run about in it, and dirt and filth abound. The same condition is found in many places in East and West Prussia. In most villages, as the reports of the medical inspectors show, there are low huts with clay floors, small low windows, and beds in which several persons sleep together. Little attention is given to cleanliness, a common washing-basin and towel serve for all the inmates, only rare and sparing use is made of soap, and a regular bath is unusual—

[1] Das Sanitätswesen des Preussischen Staates während der Jahre 1895-7. Bearbeitet von der Medizinal-Abteilung des Kultusministeriums, S. 129.

[2] *Kirchner, M.*, Berliner klin. Wochenschr. 1897, No. 9, S. 3 f.

[3] *von Kobylecki*, Zeitschr. f. Medizinalbeamte 1897, No. 2, S. 2.

conditions which could scarcely be improved for preserving and spreading the contagion. It is obvious, and is confirmed by all observers, that under these circumstances the family and home life form the primary nidus of the disease, and the school only in quite secondary degree.

If we imagine numerous bodies of soldiers thickly quartered in such districts in time of war, we can easily guess how great would be the danger of rapid infection, and we shall easily account for the fate of the Duke of York's army corps in 1812-3. We know from the example of Egypt that when a chronic national plague once seizes a rural population, it acquires an extremely tenacious and unalterable character. At that time the same condition prevailed there as to-day—viz. a dormant endemic complaint.[1] The soldiers slept in the beds of infected inhabitants, dried their faces and eyes with the same towels, and often came into still closer personal contact: it is little wonder that they became infected with Trachoma, even to an appalling degree, so as to be incapacitated.

As regards the number of trachomatous persons in these provinces, Kuhnt,[2] undoubtedly one of the best experts on Trachoma, in 1897 estimated the total in East Prussia alone at 75,000 at least—*i.e.* 3·7 per cent. of the whole population. He adds that in East Prussia the upper classes are also infected, and that no class is now perfectly free. Bach,[3] who gives the numbers compiled by Vossius, reports that of the total number of eye patients treated in Königsberg from 1888 to 1892, 134·3 per thousand were Trachoma. Kuhnt[4] found in the same town from 1891 to 1897 an average of 154 per thousand, all undoubted cases. In his report[4] of June 13th, 1896, to the Board of Education, he writes: "It is as yet impossible to obtain even an approximate idea of the extraordinary extent of granular disease. During my examinations of the

[1] *Greeff*, Studien über epidemische Augenkrankheiten. Jena 1895, S. 57.
[2] *Kuhnt*, Ueber die Therapie der Conjunctivitis granulosa. Jena 1897, S. 18.
[3] *Bach*, Inaug.-Diss. Giessen 1897, S. 26.
[4] *Hirschberg*, Deutsche med. Woch. 1897, S. 31 f.

schools I have not yet found a single class in which there were not one or two cases. I am convinced that the disease is on the increase."

In West Prussia, Greeff,[1] who was also commissioned by the Government to investigate the spread of Trachoma, estimates the total number of patients in 1898 at 47,250—*i.e.* 4·5 per cent. of the population. As Greeff supports the dualistic theory, distinguishing follicular catarrh sharply from Trachoma, his numbers will probably not be too high. Schneller, in Dantzic, between 1875 and 1892 had 1,751 cases of Trachoma among 30,000 eye patients, —*i.e.* 58·3 per thousand of the total number.

Hirschberg,[2] in examining the pupils in the gymnasia (high schools), found the proportion of Trachoma cases to be 50—100 per thousand; in the town schools, usually 100—150 per thousand; and in the village schools, 200—470 per thousand. On making an exact count in two villages in East Prussia, Kalinowen and Milewen, in the district of Lyck, he found Trachoma in 100 per thousand of the population; in severe form in 10—20 per thousand.

In the province of Posen reports[2] are available from the towns of Bromberg and Posen. In Bromberg, between 1883 and 1896, Augstein had 1,597 cases among 13,374 eye patients—*i.e.* 119 per thousand. In Posen the numbers given by Wicherkiewicz and Pincus were 130·4 and 160 per thousand. Hence we must conclude that the province of Posen was seriously infected.

Silesia shows slight infection for the greater part, Upper Silesia a moderate degree. The most infected district, Oppeln, lies very low,[3] whilst the least infected part, Halberschwerdt, has the highest altitude. In 1894 Vossius found Trachoma occurring in 20—90 per thousand of all eye patients in Silesia. Oppeln lies only 100 metres above the sea level, is frequently inundated, and contains

[1] *Greeff*, loc. cit. S. 50.
[2] *Hirschberg*, Deutsche med. Woch. 1897, S. 30.
[3] *Wolffberg*, Nagels Jahresbericht. 1893, S. 226.

among its inhabitants 66 per cent. Poles to 34 per cent. Germans. The former are comparatively much more affected.

Just as these provinces, the worst affected in all Prussia, receive Trachoma from the east (from Russia, Galicia, and probably from Hungary), so they continually pass it on to the west, following the general trend of commerce—an undoubted and very remarkable fact. Trachoma has unmistakably set out on a slow migration west. Until quite recently in Germany it was confined to East and West Prussia, the eastern part of Pomerania, the east of Posen, and several small areas in the Eichsfeld, and in Hesse. In the last few years we have received reports from the eye clinics of almost all the universities of continual sporadic influx of the disease.[1] The chief blame for this deplorable state of affairs rests on the tramps who wander westwards from Russia and the eastern parts of Prussia for weeks and months in every year, in order to find employment in mines or buildings, or as labourers on farms, returning home when their work is finished. In this manner, according to the medical reports,[2] the disease was carried into the districts of Stettin, Stralsund, Merseburg, etc., by the so-called "Saxony tramps" (*Sachsengänger*), by miners into the manufacturing districts of Westphalia and the Rhine, by navvies on the Kaiser Wilhelm canal into Holstein, and by navvies on the Ems-Jade canal into Oldenburg and Hanover. M. Kirchner has laid great stress on this grave danger. Great credit is also due to him for first getting the Government to wage war on Trachoma.

A similar rôle to that of the Russian and Polish labourers on the east is played by Italians on the south; but as the southern German states are less susceptible to Trachoma, they do not work so much mischief.

[1] Berl. klin. Wochenschrift 1900, No. 9, S. 198. Vortrag von *M. Kirchner*.

[2] Das Sanitätswesen des Preussischen Staates während der Jahre 1895-7, S. 129.

The German Empire is further exposed to the introduction of the disease from Bohemia, Belgium, and the Netherlands.

Besides the great centre for Trachoma in the east of Germany, other areas in the west have to be taken into account, although affected to a less extent—viz. Hesse-Nassau, especially the district of Biedenkopf on the Upper Lahn, parts of Rhineland, especially the neighbourhood of Bonn, of Westphalia, the western part of the Palatinate of the Rhine, Mülhausen in Alsace, the Eichsfeld, and parts of Thuringia. In the eastern part of Further Pomerania, too, as well as in Mecklenburg, the disease has gained a footing within the last decade.

In Central Germany it occurs very rarely, and only in sporadic cases. Saxony and Thuringia are in parts free from it, in parts only slightly infected.

The states of Southern Germany—Baden, Würtemberg, and Bavaria—are practically exempt. Only Hohenzollern,[1] which is infected, according to Schleich, by discharged Prussian soldiers, and the marshy district around Bayreuth in Upper Franconia, form isolated patches of infection, the latter area extending as far as Erlangen.

The following figures, giving the proportion of Trachoma cases to the total number of eye patients under medical treatment, are quoted from the statistics of Vossius[2] (1894): East Prussia, 134·3 per thousand; West Prussia, 58·3; Pomerania, 11; Posen, 134; Silesia, 22—90; Saxony, 6—26·3; Schleswig-Holstein, 11·1; Hanover, 83·1 (?); Westphalia, 41·2; the Rhine Province, 12·8—82·8; and Hesse-Nassau, 12·8—103·8. These figures are now only approximately correct; for more exact information Hirschberg's *Geographische Verbreitung der Körnerkrankheit*, which contains a rich collection of statistics, should be consulted.

According to the most recent observations, however, a

[1] *Sattler*, Verhandlungen des X. internationalen medizinischen Kongresses 1890. Berlin 1891, S. 30.—Sanitätswesen des Preussischen Staates für 1898—1900, S. 149.

[2] *Vossius*, Nagels Jahresbericht 1897, S. 108.

distinct decrease in the amount of Trachoma has occurred during the last ten years, especially in the western part of Germany. Many observers, such as A. Peters[1] and Pröbsting, regard this as simply due to epidemiological fluctuation.

In the Prussian German army[2] the number that enlisted in 1867 was 32·3 per thousand of the total strength; in 1868, 25·8; in 1869, 26·3. The Franco-German war of 1870-1 did not cause any rise, and since then there has been a continuous decrease, as the following table shows.[3]

Year.	Cases (per thousand).	Unfit for Service (per thousand).
1875-76	9·4	0·65
1876-77	7·0	0·48
1877-78	6·2	0·47
1878-79	5·6	0·61
1879-80	6·0	0·53
1880-81	5·3	0·54
1881-82	4·4	0·47
1882-83	4·3	0·46
1883-84	3·5	0·47
1884-85	3·7	0·29
1885-86	2·7	0·34
1886-87	2·0	0·42
1887-88	2·1	0·36
1888-89	2·0	0·38
1889-90	2·0	0·42
1890-91	1·9	0·30
1891-92	1·8	0·41
1892-93	1·4	0·32
1893-94	1·5	0·31
1894-95	1·3	0·31
1895-96	1·1	0·26
1896-97	1·2	0·24
1897-98	0·92	0·21
1898-99	0·69	0·14
1899-1900	0·55	0·12

As regards the number of patients in the individual army corps, the I. (East Prussia) has for years stood first,

[1] *Peters, A.*, Münch. medizin. Wochenschr. 1903, No. 3.

[2] *Kirchner, M.*, Grundriss der Militär-Gesundheitspflege. Braunschweig 1896, S. 451.

[3] Nach d. Sanitätsberichten über d. Königl. Preuss. Armee, etc.

whilst the XVII. (West Prussia), the II. (Pomerania), and the V. (Posen) show a considerable number. The average entry between 1890 and 1900 is shown in the following table:—

I.	Army Corps	(East Prussia)	5·34 per thousand.
XVII.	„ „	(West Prussia)	4·39 „ „
II.	„ „	(Pomerania)	2·65 „ „
V.	„ „	(Posen)	2·35 „ „
III.	„ „	(Brandenburg)	1·67 „ „
IV.	„ „	(Saxony)	1·41 „ „
VI.	„ „	(Silesia)	1·40 „ „
XVI.	„ „	(Lorraine)	0·88 „ „
VII.	„ „	(Westphalia)	0·64 „ „
X.	„ „	(Hanover)	0·58 „ „
IX.	„ „	(Schleswig-Holstein, Mecklenburg)	0·49 „ „
XI.	„ „	(Hesse-Cassel, Saxony, etc.)	0·39 „ „
XV.	„ „	(Alsace)	0·34 „ „
G.K.	„ „		0·22 „ „
VIII.	„ „	(Rhineland)	0·20 „ „
XII. (I.K.S.)	„ „	(Kingdom of Saxony)	0·18 „ „
XIV.	Army Corps	(Grand Duchy of Baden)	0·17 „ „
XIII. (K.W.)	„	(Kingdom of Würtemberg)	0·04 „ „

Amongst the newly formed army corps of 1898 the XVIII. (Grand Duchy of Hesse, Hesse-Nassau) had an annual quotum of 0·10, and the XIX. (II. K.S.), 0·12 per thousand. To these may be added the I. Bavarian with 0·18, and the II. Bavarian with 1·1 per thousand. No figures are available as to the III. Bavarian.

It is worthy of note that the number of patients in each army corps no longer gives an accurate gauge of the ratio among the civil population in the various provinces, because of the frequent drafting of recruits into other provinces.

As regards the number of patients per month we need only mention the enormous rise during October, the month in which recruits are enrolled. It is then nearly five times more than the highest in the other months. The latter do not show any great difference amongst themselves.

In the German navy[1] Trachoma plays no great part. The average from 1890-5 was 0·9 per thousand, and from 1897-9, 0·5. The large rise during 1896-7—to 23·1 per thousand—was not due to Trachoma, but to follicular conjunctivitis, which raged as an epidemic in the great barracks at Wilhelmshaven.

The cases observed occurred as a rule among recruits from the East Prussian provinces. In 1897-8 the infection was caught in one case in New Guinea, and in 1898-9 in two cases in Kowchow, through contact with Chinese.

The number of cases of Trachoma in the German army and navy are even less than those cited, for cases of follicular catarrh are often included in the reports.

Russia takes the first place among European countries affected with Trachoma. There are no historical records to show how long Trachoma has been endemic here, but to judge from its present extent, it must have become established centuries ago. Eble[2] quotes a statement made by the Russian physician Lang in 1825, that this form of ophthalmia had occurred sporadically in the Crimea from time immemorial, chiefly affecting the lower classes of Tartars. Lang further states that between 1782 and 1805 two epidemics of contagious ophthalmia occurred, first in the town of Sebastopol, spreading thence into the country; and that in recent years it occurs more frequently, chiefly affecting the troops garrisoned in some of the towns. Lang is of the opinion that the disease probably came originally from Egypt, and was carried into the Crimea by the numerous pilgrims returning from Mecca through Cairo. He brings forward no proof of this assertion.

According to Reutlinger,[3] epidemic and endemic eye diseases have been almost continuous in the Russian army

[1] Statistischer Sanitätsbericht über die Kaiserl. Deutsche Marine. 1890—1900.

[2] *Eble*, loc. cit. S. 52.

[3] *Reutlinger*, Wojenno-medizinski Journal. St. Petersburg 1886. W. Roth's Jahresbericht 1886, S. 74.

since 1820 to the present day. We find numerous articles about them in the literature during the last twenty-five to thirty years.

According to Reutlinger, too, the Crimean peninsula was always most affected. The sharp, chalky dust formed a predisposing cause, and the disease was so prevalent that it went by the name "Krymsa"—*i.e.* the Crimean ophthalmia. Next to the Crimea the western provinces and the St. Petersburg and Caucasus military districts are said to have been most affected.

Skrebitzky[1] states that of the extremely large number of cases of blindness among the Russian soldiers in the Russo-Turkish war of 1877-8, only 5 per cent. were due to wounds, the remainder being caused by contagious eye diseases, chiefly Trachoma. At the instance of the "Central Bureau for the Maintenance of Needy Soldiers' Families," Skrebitzky in 1879-80 made journeys into the central and southern provinces of Russia. He recognised the extraordinary prevalence of blindness throughout the country, and directed the attention of the public to it. He estimated the number of blind in Russia at 400,000, and showed the principal causes to be smallpox, ophthalmia neonatorum, and Trachoma. Walter (Odessa) reports that 18 to 19 per cent. of all cases of blindness in Russia are due to Trachoma; according to Sergieff, Aljantschikoff, Kuscheff, and others, 30 per cent. In some districts the proportion is said to rise to 40 and even 82 per cent.[2] According to Madame Putiata Kerschbaumer, who quotes from the reports of the Czarina Maria Blind Asylum, the number of Trachoma cases in some Russian provinces form 800 (!) per thousand of all eye patients, the patients rendered blind constituting 92 per cent. of all cases of incurable blindness. Truly startling figures, when one considers that in these cases the blindness might be averted!

[1] *Ischreyt*, Zentralbl. f. prakt. Augenheilk. 1895, S. 321.
[2] *Andogsky*, Archiv f. Augenheilk. Bd. XXX. S. 178.

Fialkowsky[1] reports that in 1883 the Russian army contained 5 to 25 per cent., some divisions over 40 per cent., of soldiers affected with eye diseases, by which at least one-tenth of the army would be rendered temporarily unfit for service. According to Lawrentjew,[2] out of 2,417,746 men, the fighting strength of the army, there were 240,554—*i.e.* 9·94 per cent.—eye patients in 1883-5, and of these the serious cases in hospitals numbered 67,384, or 28 per cent. of the total number of eye patients. Considerably more than half of these had Trachoma. Of these, 2,253, or 1·94 per cent., partially or completely lost their sight, apart from the large number that were sent on furlough, or were discharged as unfit for duty.

Talko[3] in 1885 found on an average 83·6 cases of Trachoma per thousand among the infantry, 64·1 among the cavalry, 59·9 in the engineers, and 23·8 in the artillery. Among the men in their first year of service there were calculated to be 2·3 per cent., with Trachoma, in their fourth year as many as 8·2 per cent.[4]

In the Cossack regiments Trachoma is said to have been rare, because it did not exist among the young Cossacks on the Don, and the Cossacks during their period of service were more employed in the open than in barracks.

According to Iskersky,[5] nearly 45,000 cases of Trachoma were numbered in the Russian army in 1890. Kamocki[6] (Warsaw) gives the total number from the official health report for 1892 as 58,369—*i.e.* 66·9 per thousand of the effective force. Of these 12,877, or 71·6 per thousand, belonged to the military district of Warsaw alone. According

[1] *Fialkowsky*, Wojenno-sanitarnoje Djelo 1883, No. 13 und 14.

[2] *Lawrentjew*, Wojenno-medizinski Journal 1887. Roth's Jahresbericht 1887, S. 122.

[3] *Talko*, Roth's Jahresbericht. 1887, S. 120.

[4] See *Troitzky*, Schweigger's Archiv Bd. 18, S. 490.

[5] *Iskersky* (St. Petersburg), Wjestnik oftalmologii 1893. Zentralblatt f. prakt. Augenheilkunde 1893.

[6] Zentralblatt f. prakt. Augenheilk. 1897, S. 157.

to Reutlinger,[1] the proportion of Trachoma varies among the different divisions of the army between 0 and 337 per thousand. The highest figures were yielded by the district of Kieff and the Caucasian troops.

The chief cause of this widespread distribution of Trachoma is stated by all authors with great unanimity to be the enrolling of recruits already infected, a practice which is allowed by the regulations as long as the cornea is not seriously affected. Lawrentjew stated in 1887 that 13·7 per cent. of the new recruits were suffering from Trachoma: it is true that from 1894 to 1900 he found only 5·7 per cent. in the military district of Moscow. Talko calculated in 1887 that 8,000 to 10,000 trachomatous men were enrolled every year. Before they enter the service Trachoma appears as such a harmless complaint that the victims are scarcely aware of its presence. Among soldiers, however, the influence of barrack life makes it a very serious disease, frequently followed by loss of sight. Moreover, the introduction of infected recruits leads to enormous spread, and the discharge of men not completely cured helps further extension of the disease amongst the people.

Reich,[2] in 1883, wrote that the enrolment of trachomatous men continued, in spite of the solemn warning of all experts, the reason being that otherwise diminished enlistment would get the Military Department into trouble, any law to the contrary affording a chance of escape from service.

Within the last decade a gratifying change for the better seems to have set in, due probably to improved sanitary measures and the introduction of the mechanical method of treatment. The following table, taken from the official reports, was placed at the disposal of the author by the Imperial Russian Health Administration:—

[1] *Reutlinger*, Inaug.-Dissertation St. Petersburg 1898, Zeitschr. f. Augenheilk. 1899, Bd. I. S. 296.

[2] *Reich*, Wojenno-sanitarnoje Djelo 1883, No. 31.

STATE OF TRACHOMA IN THE RUSSIAN ARMY
FOR THE YEARS 1890—1901

Year.	Cases.		Unfit for Service.	
	Absolute Numbers.	Per Thousand.	Absolute Numbers.	Per Thousand.
1890	11,087	13·3	315	0·3
1891	10,385	12·2	330	0·3
1892	8,235	9·4	400	0·4
1893	7,214	8·1	491	0·5
1894	6,602	7·2	586	0·6
1895	7,259	7·8	651	0·2
1896	6,651	7·0	660	0·7
1897	6,178	6·4	787	0·8
1898	5,847	5·9	558	0·6
1899	5,736	5·8	551	0·6
1900	6,136	6·5	604	0·6
1901	7,201	7·2	869	0·9

It should be stated that the number of cases refers only to those treated in hospitals, so that the trachomatous soldiers at the front are not included.

In the Russian navy Trachoma has decreased since the recruiting order of 1883, whereby men who were infected could no longer be enlisted. According to Ljubinski,[1] the numbers of trachomatous naval recruits were :—

1881 . .	1·6 per cent.	1887 . .	0·5 per cent.
1882 . .	1·6 „	1888 . .	1·2 „
1883 . .	1·1 „	1889 . .	0·6 „
1884 . .	1·5 „	1890 . .	0·2 „
1885 . .	0·7 „	1891 . .	0·3 „
1886 . .	0·3 „		

In the spring of 1889 Ljubinski[2] was instructed to examine 2,696 men in the Black Sea fleet; he found 113 cases of Trachoma—*i.e.* 3·8 per cent.

Among the civil population Trachoma is very prevalent, and very few districts of Russia are quite free from it.

[1] Roth's Jahresbericht 1892, S. 110.
[2] Ibid. 1889, S. 131.

The Baltic provinces are known to have been an old focus. Exhaustive accounts are to hand from Livonia and its university town of Dorpat.

Copious material was published by Weiss[1] in 1861, collected by the professors of Dorpat and their senior pupils, who every year searched one by one the various districts of the Baltic provinces. Weiss found that Trachoma was by far the most common eye disease among the peasantry of Livonia. He considered that Trachoma could occur as a sequel of old inflammation, and most readily developed in a conjunctiva which had been left lax and susceptible by previous inflammation and catarrh. Weiss, Adelmann, and von Holst blame the nature of the soil in these parts for the origin and spread of the disease. Swamps are said to be specially favourable: whilst in some districts the proportion of cases is 10·9 per thousand, in others it reaches 23·9 to 30, and even 44·6. Pollution of the air by the wetting and drying of flax is held by Weiss to be another cause in some parishes. He also lays emphasis on the fact that in regions abounding in marshes, but exposed to free currents of air, Trachoma is less common. The effluvia from the swamps cannot have so much effect in these regions, on account of the purifying action of the winds. Finally, the dark, low dwellings, continually filled with smoke, and devoid of all rational ventilation, which are often met with, especially in the Esthonian or north part of Livonia, are said to have an injurious influence, the smoke irritating the conjunctiva and rendering it more susceptible. Weiss positively denies any increased predisposition to Trachoma among the Esthonians as a race, bearing in mind their Mongolian type of skull. He found no time of life exempt from the disease: he met with it from infancy to extreme old age. An increase in frequency could be observed towards the thirtieth and fortieth years of life, after which the proportion fell again.

[1] *Weiss*, Inaug.-Diss. Dorpat 1861.

Oehrn[1] states that during the years 1856-9 v. Oettingen and v. Samson found nearly 1 per cent. of the total population affected with Trachoma—in some districts as many as 4½ per cent.; and that in 1857 Reiher discovered the disease in 62 per cent. of the scholars in the village and parochial schools. Oehrn in 1892, from a collection of many facts and the examination of many schools, ascertained that 11·4 per cent. of the school children were suffering from Trachoma in the Lettic or southern part of Livonia, whilst in the northern or Esthonian part there were 23·8 per cent., or more than twice as many. The amount of Trachoma, he asserts, rises regularly in passing from south to north; and this is explained by the difference in civilisation and social life, for the Letts are far more cultured than the Esthonians. Of the total number of eye patients that received medical treatment, 372 per thousand were found to be Trachoma. The proportion among males as compared with females is nearly 3 : 4; according to Weiss, 0·7 : 1·5. This ratio only holds good for adults, amongst whom nearly half the total number had affection of the cornea. Since the investigations of Weiss a diminution of Trachoma could be observed in Livonia.

In Finland, a country possessing many rivers, lakes, swamps, and forests, Trachoma is very prevalent; indeed, Hirschberg states that it has more cases than any other country in northern Europe. From 1886 to 1897, 31·5 per thousand of the conscripts in Finland were exempted on account of eye disease, especially Trachoma and its sequelæ.[2] Trachoma and other eye affections are commonest in the most northern province of Uleaborg. In Sweden Trachoma is the cause of only 0·85 per cent. of all cases of blindness, whilst in Finland it is answerable for 30 per cent.! Trachoma and blindness are also more than twice as common among the Finns than among the Swedes in Finland. This difference, however, is due, not to difference

[1] *Oehrn*, Zentralblatt f. prakt. Augenheilk. Bd. XVII. S. 79 ff.
[2] *Lindén*, Finska Läkar. Hand. 1899, 41, No. 1.

in race, but to certain habits and customs which are peculiar to the different regions. This is proved by Widmark in his interesting research on the distribution of Trachoma in the Fryk Valley in Wermland, in Sweden, where the Swedes suffer more than the Finns who have migrated there. In this connection Widmark lays stress on the fact that in the North, Trachoma is an old disease which is spoken of as being endemic in certain regions even in the medical literature of the eighteenth century. The blind in Finland amount to 15·5 (according to Hirschberg, 21·9) per 10,000 of the population, whilst in the neighbouring countries, Sweden, Norway, and Denmark, the numbers are 8·3, 12·8, and 5·3 respectively. Finally, Widmark emphasises the fact that blindness has diminished very considerably in Scandinavia and Finland within the last decade, except in Sweden, from which large numbers of young people with good vision have emigrated.

Siberia is also very seriously affected with Trachoma. Madame Putiata Kerschbaumer[1] was sent there in 1900 as the chief of an "ophthalmic flying column." This consisted of several oculists, male and female army surgeons, and sisters of the Red Cross. Up to that time there were only two eye-hospitals in the whole of Siberia—one the university eye clinic in Tomsk with ten beds, the other in Usolia, near Irkutsk, with five beds.

The column worked for eight months in cities and large market towns along the Trans-Siberian Railway, the existing hospitals providing a considerable number of beds for the reception of eye patients. Small detachments visited some places remote from the railway, and worked in the hospitals under the direction of the assistant surgeons. Not less than two months were spent in each place. The public were officially informed of the arrival of the column, and those suffering from eye complaints flocked in great numbers to the place, many travelling 100 to 350 versts, or kilometres, on foot, often in the coldest weather.

[1] *Putiata Kerschbaumer*, Zeitschr. f. Augenheilk. Bd. VII. 1902, S. 221.

There were 8,342 cases of Trachoma treated—*i.e.* 384 per thousand of all the eye patients. Of the total number, 1,137, or 12·41 per cent., were cases of incurable blindness, the causes being smallpox, 18·5, per cent.; Trachoma, 15·6, per cent.; and ophthalmia neonatorum, 3·3 per cent.

The worst victims of Trachoma in Siberia are people who have migrated from Russia, bringing the disease with them. The spread of the disease is favoured by the bad sanitary conditions which prevail, and it rapidly extends among the native population. The number and severity of the cases keep pace with the unfavourable material, educational, and sanitary conditions.

The Chuwashian colonies[1] are the most affected with Trachoma; these people live in extraordinary misery, huddled together in small huts. In a colony in the province of Tomsk only one house in fifty-two was free from the disease. Among the more wealthy peasantry, living under better hygienic conditions, only one or two cases were seen.

It may be mentioned that the so-called "ophthalmic flying columns," founded by Professor Belljarminow, are organised by the "Board for the Prevention of Blindness," which is honoured by the patronage of H.M. the Czarina Maria Feodorowna. Having a definite plan before them, they have met with much success.[2] Since 1893 expeditions, fully equipped with instruments and drugs, have been sent out during the summer university vacations into various districts, under the direction of ophthalmologists, with the object of giving treatment, gratis, to the people.

The Board for the Prevention of Blindness, besides making a scientific investigation of blindness, have set to work to battle with the causes of it, and for this object have made it their main purpose to found dispensaries and hospitals, to increase the number of specialists, to circulate popular literature on the subject, etc. Although the efforts

[1] A Tatar tribe, settled on the right bank of the Volga.

[2] *Ischreyt*, loc. cit. S. 321.

of the flying columns have been attended by temporary rather than permanent results, on account of the very limited duration of their period of work, yet their value to the Russian doctors must not be underrated. This is due to the great impulse given even to the general practitioners by such a wealth and variety of material.

According to Belljarminow, no fewer than 142 flying columns were fitted out between 1893 and 1900, and these treated 218,840 patients, and performed 65,668 operations, besides the 111,187 patients treated, and 20,001 operations performed, in hospitals. Within the period mentioned sixty-three ophthalmic institutions, including ten hospitals, were founded by the Board, eye dispensaries were opened in Tashkent, Tiflis, and Astrachan, and a large number of free beds were endowed in various hospitals. In the face of these facts, as Ischreyt of Dorpat observes, we cannot but be convinced that the time has now arrived for great success in the treatment of these wretched people throughout the Russian Empire.

In conclusion, some figures are quoted from Hirschberg's monograph,[1] showing the amount of Trachoma in the various provinces. For convenience they may be arranged in a table, as follows :—

Moscow . . .	24 to 40	per thousand of all eye patients.
Rostow . . .	60	„ „ „
St. Petersburg .	96	„ „ „
Helsingfors . .	102	„ „ „
Saratow . .	114	„ „ „
Lodz . . .	116	„ „ „
Libau . . .	121	„ „ „
Warsaw . .	124	„ „ „
Reval . . .	146	„ „ „
Dorpat . . .	180 to 350	„ „ „
Riga . . .	200	„ „ „
Kasan . . .	180 to 220	„ „ „
Kiew . . .	250	„ „ „
Bessarabia . .	250	„ „ „

[1] *Hirschberg*, Deutsche med. Woch. 1897, S. 32.

Hirschberg was unable to find any districts in Russia which were absolutely free from Trachoma, or only slightly affected.

Austria-Hungary is less over-run with Trachoma than Russia, but must still be reckoned among the European countries infested with the disease, the eastern part being especially affected.

A full account of the statistics on Trachoma in Cisleithania was given by von Reuss[1] at the eighth International Congress of Hygiene and Demography at Budapest in 1897. From his very thorough investigations he came to the following conclusions. The mountainous regions, especially amongst the Alps, have very little Trachoma. This is due to the fact that the population is nowhere great, the means of communication are not good, whilst factories and workshops are few. Wherever Trachoma occurs in these districts, it has been introduced by labourers. If it is more common among the Slavs in the south and the Jews in the north, it is due to their social conditions, their poverty, filthy habits, and bad domestic arrangements.

The army is a very important factor in the spread of Trachoma, for it transmitted the disease to the civil population after the epidemics at Klagenfurt, previously mentioned, and also later at the fortresses of Mainz and Rastatt, whilst, on the other hand, it is continually receiving fresh Trachoma through recruits coming from infected districts.

In some regions the influx of workmen—farm labourers, builders, etc.—which occurs at certain seasons of the year, is of importance.

If we look at the map of Cisleithania, beginning at the south-west, we find that Trachoma travels from Italy into Italian Tyrol. Istria, Dalmatia, and the regions round Görz and Triest, which are much infected, probably derive the disease from Italy and the eastern provinces, including

[1] Zentralblatt f. prakt. Augenheilkunde 1898, S. 314.

Hungary. From Istria, Croatia, and Hungary the disease spreads towards Carniola and southern Styria.

Trachoma occurs all over Carniola, endemic in some places, sporadic in others. Neither nationality, nature of soil, nor altitude is the determining factor, but the conditions of commerce, the grade of civilisation, and particularly the want of cleanliness among the people. For the last, scarcity of water is in some degree responsible—*e.g.* in southern Carniola, where Trachoma is rife. Bock[1] found it even in places at an altitude of 1,090 metres. Where it appeared endemic it ran a virulent course, the majority of cases being amongst the peasantry and labouring classes.

In 1894 Matkowic[2] investigated the frequency of Trachoma among the Croats and Slavs, and collected 9,164 cases. In the *Book of Trachoma* kept by the authorities, 15,267 cases were recorded for the year 1897. Gipsies enjoy comparative immunity, whilst the Slavs (Croats, Servians, Czechs, and Poles), as well as the people of Finland and Hungary, seem specially prone. According to Matkowic, this predisposition is due to reduced alkalinity of the tears, with consequent attenuation of bactericidal power, caused by constitutional and climatic conditions.

The northern and western parts of Styria, a large part of Carinthia, the whole of German Tyrol and Vorarlberg, Salzburg and Upper Austria, are only very slightly affected. Lower Austria, with the exception of Vienna, has also a very low percentage of cases. The western part of Silesia is almost immune, while the eastern part, with Galicia and Bukowina, forms the true home of Trachoma in Cisleithania.

Bohemia occupies an intermediate place. The most important area, according to Reisinger,[3] is the Elbe Valley,

[1] *Bock*, Ueber Trachom. Mit besonderer Berücksichtigung seines Vorkommens in Krain. Wien 1900, S. 30.

[2] Zentralblatt für prakt. Augenheilk. 1898, S. 507.

[3] *Bach*, loc. cit. S. 14.

from Colin to Leitmeritz, and offshoots along its tributaries. This district is thickly wooded, fertile, and marshy, and nowhere has an altitude of more than 200 metres. Here Trachoma occurs in about 120 to 140 per thousand of eye diseases. In spring these parts are inundated, the bed of the river being very shallow; while in summer the rivers are often mere quagmires.

Further, Trachoma is found in the plateau which surrounds this valley (with an altitude of 200 to 300 metres), in a plateau in southern Bohemia (altitude, 300 to 400 metres), containing numerous swamps and lakes, and lastly in a small area south-east from Prague (over 300 metres high). All these districts have a very heavy rainfall during the spring, and are also infected with malaria, which, however, does not extend so widely as Trachoma. During the spring and summer months Trachoma shows a considerable increase, but from August onwards a rapid decrease. Generally speaking, it ceases to exist in Bohemia at an altitude of 450 metres.

The north-eastern part of Bohemia must be regarded as primarily free from Trachoma: it is not endemic there, but only imported, and, according to Bayer,[1] yields a total of 16·6 per thousand of all eye patients.

The worst infected part of Cisleithania is Galicia. From 1892 to 1898 no fewer than 5,938 cases were treated in the hospital at Lemberg[2]—*i.e.* 285·4 per thousand of all eye patients.

The distribution of Trachoma in Cisleithania, according to Reuss,[3] is as follows:—

Italian Tyrol . . .	40	per thousand of all eye diseases.
North Tyrol . . .	4	,, ,, ,,
Salzburg	7	,, ,, ,,
Upper Austria . . .	15	,, ,, ,,
Carinthia	11·6	,, ,, ,,

[1] Nagel's Jahresbericht 1890, S. 115.

[2] *Machek*, Bericht über die Wirksamkeit der Augenabteilung des galizischen Landkrankenhauses zu Lemberg für 1892-8. Lemburg 1899.

[3] Nagel's Jahresbericht 1896, S. 111.

Styria	29·5	per thousand of	all eye	diseases.
Carniola	66·7	„	„	„
The Coast and Dalmatia	84·4	„	„	„
Lower Austria and Vienna	35·9	„	„	„
Bohemia	40	„	„	„
West Silesia	under 10	„	„	„
East Silesia	40	„	„	„
West Galicia	110	„	„	„
East Galicia	over 110	„	„	„

We are indebted to Feuer[1] for exhaustive investigations on the distribution of Trachoma in Transleithania (Hungary). This author, previously an army surgeon, became Medical Officer of Health in Hungary. In 1895 he found 27,921 cases of Trachoma, and 7,713 suspected cases—in all 11·2 per thousand of the entire population.

Apart from the sporadic cases which were to be found in most parts of the country, he discovered two chief foci. The larger primary one was in the south, the so-called Alföld, a low-lying tract, sandy in places, and everywhere dry and free from swamps, between the Danube and the Theiss, and east of the Theiss. The smaller one was in the north, in a very mountainous and well-wooded region, the centre of which is formed by the Privigy district of Neutra.

These two districts are diametrically opposed to each other, not only in orographic, but also in ethnographic, educational, and economic respects. In both the peasants and working classes are chiefly affected. The population of the southern area, composed of Hungarians, South Slavs, and Germans, are for the most part well-to-do and cleanly; they do not wander from their homes, and, although they live together in large families, yet they inhabit comparatively good dwellings, and have had a fairly good education. The people in the northern area, on the other hand, composed of Slowaks (North Slavs) and Swabians, are exceedingly poor, and dirty in their habits; they live in wood huts, which often have no chimney, and the large

[1] *Feuer*, Die Verbreitung des Trachoms in Ungarn und das behördliche Vorgehen gegen dasselbe. Stuttgart 1897, S. 61.

family is housed in one room, along with pigs and poultry. As these people cannot obtain the bare means of subsistence in their own homes, they have to go as labourers into the more prosperous plain of South Hungary (Alföld), and this very fact forms the link between the two centres of Trachoma in the north and south. The labourer from the north acquired the disease in Alföld, and took it home, where it found a favourable soil, although it was recent in origin, and had to spread in a mountainous district. It nevertheless assumed far more serious proportions as an endemic disease than in the low-lying tableland that gave it birth.

The contagion was no doubt brought to the Alföld district by the army, in which, as we have seen, the disease had been prevalent since the second decade of last century. The south-eastern portion of Alföld was formerly the military frontier for protection against the Turks, and was occupied almost solely by the families of the soldiers up to 1873, when the latter were disbanded. The Border regiments were composed of Croats and Servians, and afterwards of Wallachians (Roumanians); they were infested with Trachoma, as we have already seen, and in 1833-4 Friedrich Jaeger found 920 out of 1,238 men in the 2nd Battalion of the Peterwardine Borderers in Klagenfurt (*i.e.* 74 per cent.) affected with the disease. It may be assumed with great certainty that many of these patients returned to their homes not fully cured, and hence the disease became widely disseminated over the province.

Feuer, who travelled through the infected areas, established the fact that the German Banatian regiment, which was recruited from Alföld, suffered so severely from Trachoma in Bukowina in 1848, and again in Italy in 1859, that it had to be disbanded in the latter seat of war. He saw numerous veterans with cicatrised Trachoma, many blind in one or both eyes.[1]

[1] The blind in Hungary numbered in 1890, 10·5 : 10,000 ; in 1880, 13 : 10,000 (*Imre*, Zeitschrift für Augenheilkunde, Bd. III. 1900, S. 455).

It is exceedingly characteristic of the epidemiology of Trachoma that, while it could be proved to have been prevalent in Alföld for several decades, it did not arouse the attention of the authorities in the slightest degree. It was only in 1883 that it was really discovered by a judge, who was struck by the number of people affected with eye disease appearing before him in court,[1] a discovery which led to the commission undertaken by Feuer. In 1884 he examined the entire population in the three southern districts of Torontal, and out of 95,000 inhabitants, 5 per cent. on an average were afflicted with Trachoma, and in addition to these large numbers had cicatrices.

To illustrate the mode of transmission of the disease, Feuer writes[2]: "In a certain parish five daughters from a trachomatous family married. All the five families into which these young wives were brought appeared on the list of patients after an examination made in the open air in front of the town hall. In all five families the disease was most advanced in the wives."

Moreover, Feuer ascertained with certainty that the disease was conveyed into Hungary by the transference of cavalry, who were often stationed in Poland and Galicia. Thus, the 8th Polish Uhlans between 1850 and 1860 brought Trachoma from their homes and infected the Hungarians amongst whom they were quartered. The 16th Hussars, a regiment recruited from a district in Hungary which is almost exempt from Trachoma, returned home from Galicia in 1894 with from 300 to 400 cases.

"When the contagion," continues Feuer,[3] "has once been sown amongst a peasant population, it is scarcely possible to prevent its further spread. The younger generations continue to dwell on the same farm, young wives marry into the family, and, if they have Trachoma, transmit it not only to their husbands, but also to the whole household. The common towel, the cross before the church, which is touched and kissed by every one, the

[1] *Feuer*, loc. cit. S. 32. [2] *Feuer*, loc. cit. S. 33. [3] *Feuer*, loc. cit. S. 35.

tender embraces indulged in under the influence of alcohol, all help to spread the disease. There are also other special circumstances. Numbers of servants come together on the farms from all directions; two to four families occupy a common room, while all the children—and these poor people are greatly blessed with children—tumble about in the yard together. At the end of the year the company breaks up, to be replaced for the most part by a band of fresh servants. At another farm a group may be seen seated on the ground busily sorting dried tobacco leaves; from time to time one or other rises, goes to the table, and washes his eyes, which are irritated by the tobacco dust, and dries them with the common towel. Lastly, we may mention another abominable custom which is practised in Alföld (in the steppes of Szegedine, Dorozsma, and Kalocsa, above described as seriously affected areas). The bride or young wife, as the case may be, goes from one wedding-guest to another, washes each one's face from a common wash-basin—certainly very superficially—and then hands him the common towel to dry it with. The guest shows his appreciation by throwing a coin into the basin."

Feuer discovered several other smaller infected areas in Hungary besides the two mentioned. The same cause is at work in them as in the northern centre—*i.e.* the inhabitants migrate in large numbers in search of work, and return, bringing the disease with them.

The presence of the disease in one or two places in Siebenbürgen is also explained by the fact that a considerable portion of the population wander into foreign infected districts to obtain agricultural employment. The boarding-schools in Siebenbürgen were also formerly a nidus of infection, and were the means of spreading Trachoma among the upper classes. The emigrants that come back from America, mostly labourers, are said to threaten their homes with the disease.

It is impossible to go into all the details of Feuer's

interesting monograph. From his own experience, and from a large number of statistics, he comes to the following conclusions :—

(1) There are, in round numbers, 30,000 cases of Trachoma in Hungary.

(2) Trachoma is not dependent on nationality and race : all nationalities and races acquire it if opportunity present itself. The Jews, who are so severely affected in Galicia, suffer extremely rarely in Hungary, where civilisation is more advanced.

(3) Trachoma does not depend on the nature of the soil. In a sandy region the conjunctiva is more irritated, and hence more susceptible. In such a region the people have to rub their eyes more frequently, thus affording greater chance of infection from dirty fingers. Sand has as little power of producing Trachoma as the unjustly notorious atmosphere of the stable, which was blamed by the cavalry regiments, on account of the dust from the horses. The virus of the disease was conveyed into the sandy districts of Hungary by the Polish cavalry, who select this kind of country by preference and become quartered there.

(4) The damp and marshy nature of the soil is equally incapable of favouring the rise and spread of the disease.

(5) The high altitude of a district is no safeguard against Trachoma; nevertheless, in rocky and wooded regions it appears to be less severe and obstinate, and corneal complications are less frequent than in dusty or even sandy districts.

(6) Nor is filth of any consequence as a factor in spreading the disease, as is so often said. The cleanly inhabitants of Southern Hungary are quite as much affected as the filthy Slovaks or Swabians of the north; whilst the most filthy people of all in Hungary, the nomadic gipsies, suffer least, because they do not mix with the stationary population, nor do they use towels. They are thus protected from the scourge through the very absence of civilised customs.

(7) Trachoma spreads to the greatest extent only where the mode of life, occupation, or environment necessitates many people from different families living together without adequate prophylactic measures—wherever, in fact, plenty of opportunity is given for the conveyance of contagion from person to person. Intercourse in its various forms—of which marriage takes a very prominent place when once the disease has settled in a district—is the sole cause of endemic Trachoma. It is in this direction that the problem of prevention must be attacked. In the first place, however, quartering of soldiers among the population and the liberty of trachomatous labourers to travel would have to be stopped. Of course, such stringent procedures would not only restrict the mode of life and liberty of the individual, but would also curtail the livelihood of thousands. Yet it is only in this manner that the safety of hundreds of thousands and even millions of people could be attained.

The result of these investigations has been the organisation of a "Trachoma Service" in Hungary since 1886, largely at the instigation of Feuer, the object being to ascertain every case of Trachoma, insure its proper treatment, and prevent further infection. For this purpose regulations were first drawn up, and enforced throughout the country. They consist chiefly in the regular examination of schools and factories, and of all soldiers returning from active service, as well as all labourers leaving or entering every town. All persons affected are at once handed over to the hospitals for treatment as out-patients, or when necessary as in-patients. The measures are more stringent for districts already infected. Whenever a suspicion of Trachoma arises in a district, a "preliminary tentative" examination is made, several members being taken from each family for the purpose. If the disease is found in three or four families, the entire population is then examined. This "general examination" is repeated every year. The Government provides medical treatment free to all. For this purpose twenty-five surgeons were appointed

in 1895, and three Trachoma hospitals were erected in addition to those already in existence.

Although these stringent regulations have been on the whole consistently and rigorously carried out since 1886, the results have not fulfilled expectations. Feuer himself declared,[1] in 1897, that all these measures did not guarantee success as long as it remained impossible to effect a positive cure within two or three months—at any rate, in the majority of chronic cases.

The incidence of Trachoma in the Austria-Hungarian army is not far behind that of the Russian,[2] whilst the annual loss of men through the disease is remarkably high. It must be noted, of course, that the numbers showing the loss include soldiers temporarily disabled, and also those on furlough for health, the majority of these never becoming again fit for duty.

Hoor[3] calculates the number of recruits lost through Trachoma during the five years from 1887 to 1891 at about 7,500.

STATE OF TRACHOMA IN THE AUSTRIA-HUNGARIAN ARMY FROM 1891—1900

Year.	Cases.	Incapacitated.	
		Absolute Numbers.	Per Thousand.
1891	7·1	748	2·6
1892	7·5	675	2·3
1893	7·7	671	2·3
1894	7·1	919	3·3
1895	7·4	1,067	3·8
1896	5·3	984	3·4
1897	3·9	581	2·0
1898	2·9	650	2·19
1899	4·0	777	2·62
1900	5·0	900	3·02

[1] Roth's Jahresbericht 1899, S. 116.

[2] Statistik der Sanitätsverhältnisse der Mannschaft des K. und K. Heeres 1891—1900.

[3] *Hoor*, Prophylaxe und Beseitigung des Trachoms in der K. und K. österreichisch-ungarischen Armee. Wien 1893, S. 13.

The IV. Army Corps (Budapest) shows by far the greatest number. In the following table the various army corps are arranged according to the average amount of Trachoma per annum between 1891 and 1900 :—

IV.	Army Corps (Budapest) . .	23·9 per thousand.
XI.	„ „ (Lemberg) . .	14·3 „ „
X.	„ „ (Przemysl) . .	8·5 „ „
XIII.	„ „ (Agram) . .	7·7 „ „
VII.	„ „ (Temesvár) . .	6·6 „ „
I.	„ „ (Cracow) . .	4·0 „ „
V.	„ „ (Pressburg) .	3·9 „ „
II.	„ „ (Vienna) . .	3·6 „ „
VI.	„ „ (Kaschau) . .	2·3 „ „
IX.	„ „ (Josefstadt) . .	2·0 „ „
XV.	„ „ (Sarajewo) . .	1·9 „ „
VIII.	„ „ (Prague) . .	1·8 „ „
Military Commando Zara . . .		1·6 „ „
XII.	Army Corps (Hermannstadt) .	1·6 „ „
III.	„ „ (Graz) . . .	1·3 „ „
XIV.	„ „ (Innsbruck) . .	0·4 „ „

Taking the average over the ten years from 1891 to 1900, the various nationalities are affected in the following proportions :—

Magyars	10·0 per thousand.
Ruthenians	9·7 „ „
Poles	6·4 „ „
Czecks	4·7 „ „
Croats	1·8 „ „
Germans	0·6 „ „
Roumanians	0·4 „ „

From these statistics we see that the Austria-Hungarian army has to deal with Trachoma to almost the same extent as the Russian. Its causes have long been sought. It is known that the army derives its Trachoma from the civil population—*i.e.* from the various recruiting districts. Although it is prohibited to enrol any person suffering from Trachoma, yet this often occurs, not so much perhaps from carelessness as from the difficulties of diagnosis. After enlistment their eyes generally become rapidly worse under

the injurious influence of military regime; they discharge, and become veritable wandering sources of infection. Many are treated time after time in hospitals for long periods without success, and are then sent home uncured. Thus Trachoma, which originally came from the people, is returned with interest. At the same time it is unfortunately conveyed into districts formerly exempt.

In this sense Feuer speaks of a "real Trachoma culture, for which the army supplies the medium." He fears that at no distant period the population will be unable to supply the demand of the army for recruits.[1]

Ebert,[2] an Austrian army surgeon, wrote as follows in 1898: "The service which hygiene renders during peace is the lowest estimate of its capacity during war. At the present time, however, we see a large part of the sanitary staff and material taken up even during peace with chronic infectious diseases; in fact, by those very diseases the danger of which during war has become well-nigh proverbial. I refer to the types of this group—venereal and syphilitic diseases, and Trachoma or Military Ophthalmia. It is rightly called 'military.' Military service is not in itself capable of producing Trachoma, but it is highly qualified to favour the causes of growth. The virus of Trachoma is present and active in the army. By its continuous action Trachoma is stamped as an army disease; by the numbers of its victims every year it is indeed a soldiers' disease. It would be useless attempting to picture the dangers arising from it in a future campaign, when it has provided so many unsolved problems during peace. There is no doubt whatever that the problem of Trachoma in the army is a very real one, and even less doubt that it is unsolved. The need for its solution is universal. It is a hopeless task which we see the army surgeons performing. The prize essay on *The Prevention and Cure of Trachoma*

[1] *Feuer*, Das Trachom in der österreichisch-ungarischen Armee. Schnitzler's Klinische Zeit- und Streitfragen 1899, S. 305.

[2] *Ebert*, Zur Trachomfrage der K. u. K. Armee. Wien 1898, S. 5.

in the Imperial Austria-Hungarian Army takes account of this necessity. Yet it is notorious that the matter has made but little advance, in spite of the sad records found in the tables of statistics."

We shall later briefly touch upon the proposals for stamping out this scourge in the army, and will only mention here that several experts, such as Hoor, a former army surgeon, and Paikrt, an inspector-general, urged on principle that all persons suffering from Trachoma, which was not beyond the chance of cure, should be enrolled.[1] This is in direct opposition to the unanimous advice of all the Russian experts, that such persons should not be admitted into the army. Yet it is at first glance surprising, as well as puzzling, that the practice of admitting trachomatous recruits in the Russian army has proved of as little value as their exclusion in the Austria-Hungarian. It is, however, a notorious fact that the latter could not be strictly carried out.

In the Austria-Hungarian navy[2] there was annually an average of 36·87 cases per thousand from 1870 to 1879. On land the number was 27·21, and on sea 41·64. In the years 1870, 1871, and 1874 the disease was scarcely ever seen; whilst in 1872 no fewer than 195 cases, or 78·09 per thousand, occurred among the cadets of the training-ship *Schwarzenberg*. In 1875 there was a sudden outbreak of 453 cases on the artillery training-ship *Adria*, in consequence of which the entire crew was removed and quartered on a small island in the harbour of Pola. In 1879 there were 42·7 cases of Trachoma per thousand of all eye diseases. Of these 616, or 85·5 per cent. of the total number, appeared at Pola or on the ships in the harbour of that port. In order to place them under healthier conditions than was possible in a hospital, and at the same time to give them some employment, three tent barracks,

[1] *Ebert*, loc. cit. S. 6 f.

[2] *Frölich, H.*, Heereskrankheiten, *Eulenburg*, Real-Encyklopädie der gesamten Heilkunde, II. Aufl. Bd. IX. 226.

each containing twenty-five men, were erected on a peninsula south-west of Pola. The men stationed there were compelled to live as much as possible in the open air, and to perform various military drills and duties. Since that time the disease has diminished very considerably in the Austrian navy, as the following table shows[1]:—

TRACHOMA IN THE AUSTRIA-HUNGARIAN NAVY FROM 1890-9

1890	24·45 per thousand.	1895	1·82 per thousand.
1891	32·99 „ „	1896	1·53 „ „
1892	27·10 „ „	1897	0·99 „ „
1893	5·50 „ „	1898	1·18 „ „
1894	7·01 „ „	1899	0·90 „ „

Whereas the reports on Trachoma from Germany, Russia, and Austria-Hungary are thus numerous and exhaustive, they are few and far between from most other European countries, especially from the Balkan States. In the first place, it may be remarked that in general the three southern European peninsulas, including the Balkan States, are much infected with Trachoma.[2]

In *Constantinople*, in 1890, van Millingen[3] found not less than 1,092 cases, or 183 per thousand, in 5,917 eye patients, distributed thus:—

Amongst	1,290 Turks	110 per thousand	trachomatous.
„	1,408 Greeks	250 „ „	„
„	1,088 Armenians	190 „ „	„
„	437 Jews	100 „ „	„
„	24 Negroes	200 „ „	„
„	1,670 Foreigners	70 „ „	„

In *Roumania* the disease is said to have a wide distribution, especially amongst the Jews. Out of 2,176 outpatients attending the eye clinic of Crainicean, in Jassy, 1,139 had Trachoma—*i.e.* 520 per thousand.[4] Purulent as

[1] Statistischer Sanitätsbericht der K. und K. Kriegs-Marine 1890-9.
[2] *Hirschberg*, Archiv für Kinderheilkunde, Bd. XXV. S. 2.
[3] *Cohn*, loc. cit. S. 121.
[4] *Cohn*, loc. cit. S. 121.

well as chronic forms were met with; one child, a year old, showed pronounced Trachoma granules.

In *Bulgaria* Trachoma is very widespread. According to Christoff, of Sofia, a popular remedy amongst the peasants is rubbing the conjunctiva with rough leaves.[1]

Schmidt-Rimpler[2] observed in Constantinople in 1898 that almost all the Trachoma patients coming for treatment were in the cicatricial stage, follicles and diffuse gelatinous infiltration being found in very few cases. In the large military hospital of Haidar Pasha at Scutari, which was built for 700 to 900 patients, the vast majority of the trachomatous cases were in the cicatricial stage. The rooms in this department were painted black, and black curtains were hung over the doors towards the corridors. He found that the soldiers were not examined for Trachoma either when enlisted or when discharged. They only come under treatment when there is some obvious sign of inflammation. Turkish soldiers, moreover, whose religion urges them to wash freely in running water, are said to suffer little from Trachoma; while the Armenians, who are notoriously filthy in their habits, are frequently and severely infected in some barracks.[3]

In the fine new women's hospital at Hasséki, as well as in the Greek National Hospital at Jedikule, Schmidt-Rimpler also found cicatricial Trachoma predominant; only a few cases showed recent inflammation, some of these being recurrent attacks. Trantas, the ophthalmologist there, reckoned the proportion of Trachoma among his patients at 150 to 180 per thousand of the total number.

All these investigations tend to show that Trachoma with us is the same disease as in the East; there, however, the people only apply for treatment when the disease has so far advanced as to impair vision. Schmidt-Rimpler adds[4]:

[1] Progrès médical 1892, No. 19-25. Congrès français d'ophthalmologie 1892.
[2] *Schmidt-Rimpler*, Deutsche mediz. Wochenschr. 1898, No. 47, S. 8.
[3] *Mannhardt*, cf. *Kob*, Diss. Königsberg 1901, S. 10.
[4] *Schmidt-Rimpler*, loc. cit. S. 9.

"When the disease has become so prevalent as in the East, fostered by deficient education, poverty, and climatic conditions, very little success can be expected in the attempt to battle with it."

Van Millingen's statistics showed—

In Bulgaria	. .	440 per thousand of the population.		
In Roumania	. .	680	„	„ „
In Greece	. .	450	„	„ „
In Turkey	. .	600	„	„ „

In *Italy* Trachoma plays a greater part even than malaria. In the north it is uncommon, but it increases in frequency on going south. It is particularly common along the seaboard, and more along the Ionian than along the Tyrrhenian or Adriatic coast. In 117 districts it occurs only sporadically (0·13 to 2 per thousand of the population), in 51 it is moderately endemic (2 to 4 per thousand), in 51 it is markedly endemic (4 to 7·7 per thousand), and in 10 very widespread (up to 36 per thousand).[1]

In Liguria, around Genoa, Basso[2] states that Trachoma occurs in 110 per thousand of all eye patients. The disease is endemic in Sardinia, and markedly so in Sicily.

Marchetti, of Palermo,[3] describes the conditions amongst the Sicilians which are so favourable for the propagation of Trachoma. All medical treatment is often entirely neglected, and the people trust to St. Lucia for healing. When mild cases are cured, votive offerings in the form of a heart made of silver or wax, and bought by public subscription, are presented to her. The holy water in the churches also helps the spread of infection, for the people hope to become cured by washing in it. Moreover, public watering troughs for animals are placed on various roads, and there is a popular belief that the animals' saliva in the water can cure the eyes. Marchetti found cases where Trachoma was caught from washing in this water, and in

[1] *Minici*, Della ottalmia granulosa. Roth's Jahresbericht 1891, S. 90.
[2] Zentralblatt für prakt. Augenheilk. 1901, S. 457.
[3] Ibid. S. 287.

one case acute blennorrhœa and total blindness followed. He complains also of the want of hospitals in Palermo suitable for the treatment of Trachoma, as well as of the inefficiency of the public sanitary regulations.

In the army in 1870 Trachoma occurred in 11·7 per thousand of the total fighting force, but since then the proportion has gradually sunk to 1·84.[1] This reduction is attributed by Menici to various causes: in the first place, careful rejection during recruiting of all persons suffering from chronic conjunctivitis, which was made possible by drawing up more stringent regulations, and by the selection of experienced medical inspectors; secondly, the shortening of the time of service, even among the cavalry, because disease is most prevalent among the oldest soldiers; thirdly, improved hygienic conditions, particularly with regard to barracks and personal cleanliness.

The incidence of Trachoma in the Italian army was as follows:—

1890 . . .	2·49	per thousand	of the total strength.
1891 . . .	1·84	„	„ „
1892 . . .	1·63	„	„ „
1893 . . .	1·51	„	„ „
1894 . . .	1·60	„	„ „
1895 . . .	1·55	„	„ „
1896 . . .	1·95	„	„ „
1897 . . .	1·29	„	„ „
1898 . . .	2·13	„	„ „
1899 . . .	1·40	„	„ „
1900 . . .	1·84	„	„ „

Spain, which was for a long period (711—1031) under the sway of the Arabs, is for the most part widely affected.[2] This is shown by the relatively high proportion of blind people, 148 per 100,000 of the inhabitants, the ratio in Hungary being 128,[3] in Austria 94, in England 88, in

[1] Relazione medico-statistica sulle condizione sanitarie dell' esercito italiano 1890—1900.

[2] Zentralblatt f. prakt. Augenheilkunde 1898, S. 314.

[3] According to *Imre*, in 1890 only 105; in 1880, 130. Zeitschrift f. Augenheilk. Bd. III. 1900, S. 455.

Germany 85, in France 84, in Belgium 81, in Italy 75, and in Holland 44. As to the cause of blindness in Spain, Carreras finds that in 1,000 cases 91 are due to Trachoma, 56 to ophthalmia neonatorum, and 43 to smallpox. George Camuset, the French ophthalmologist, gives an interesting account, published in the *Annales d'Oculistique*, 1874: "The amount of eye disease seen immediately on setting foot in Spain is appalling. Through the absolute carelessness of the people, diseases of the eye are allowed to attain proportions quite unknown in France. Blind fatalism makes them suffer with indifference. The majority simply invoke the aid of St. Lucia, whose altar in every church is covered with votive offerings. The lack of ophthalmic surgeons has contributed greatly to keeping up this deplorable state of affairs. The streets of the large cities are simply besieged with blind people, who beg in groups of five or six, and roll their shrunken eyes in their sockets. The vast majority of these cases are due to ophthalmia neonatorum or to Trachoma. I have, when passing, examined every blind person, and in over 300 I have found only three or four cases of amaurosis due to disease of deeper parts of the eye."

Even so recently as 1898 the instruction in ophthalmology throughout Spain was at its lowest ebb.[1] There was no professor of ophthalmology, nor any ophthalmic hospital belonging to the state or municipality. There were only eye wards in the public hospitals, or small private eye hospitals. The streets swarm with blind beggars, the numbers increasing as one travels farther south. In Andalusia the condition of the people is very little better than on the north coast of Africa—*e.g.* in Tangier or Tunis.

Hirschberg[1] bases the following statement as to the distribution of Trachoma in Spain upon the statistics of Carreras Aragó (Barcelona), Menacho (Barcelona), and Osio (Madrid). The northern parts are either slightly or moderately affected. In the total number of eye patients

[1] *Hirschberg*, Zentralblatt f. prakt. Augenheilkunde 1898, S. 315 ff.

Trachoma occurred in the proportion of 12 per thousand in San Sebastian, 64·47 per thousand in Bilbao. The central provinces are for the most part moderately affected. Madrid, situated 650 metres above the sea level, had 50 to 80 per thousand. On the other hand, Valladolid, 679 metres above the sea, had no fewer than 266·5 per thousand.

In the eastern provinces which lie along the Mediterranean Sea the disease is very prevalent: in Barcelona, 67·3 to 120 per thousand; Castellon de la Plana, 200·0; Valencia, 238·8. The increase in numbers towards the south is marked: the southern parts were longer under Arab rule. In the southern provinces the disease prevails almost everywhere: in Cadiz, 90 per thousand; in Seville, 102·5. New trachomatous families are continually entering the mining province of Huelva from all the poorest districts of Spain and Portugal.

In *Lisbon*, in 1891, da Gama Pinto found the proportion of Trachoma among his eye patients to be 120 per thousand.

Unfortunately it was impossible to obtain any statistics as to the Spanish and Portuguese armies.

Switzerland is practically free from the disease, except in some districts on the border of Italy, from which country it is introduced, without, however, obtaining a firm hold. Trachoma is therefore seen in this country almost exclusively amongst Italian workmen, and amongst foreigners who are sent to Switzerland in large numbers to recuperate after the disease.

Emmert, of Berne,[1] writes: "Any one who has not already got Trachoma does not catch it in Switzerland (unless it is conveyed by foreigners); nor will any one who takes it into the country be cured [he obviously means "by merely living there"]; nor will he be safe from more severe or recurrent attacks." Sulzer[2] says that Swiss people may become infected in other countries; as soon as they return home they recover.

[1] Zentralblatt f. prakt. Augenheilkunde 1897, S. 310.
[2] Ibid. S. 156.

From 1881 to 1899 there were 133 cases of Trachoma in Eastern Switzerland,[1] the altitude of which averages 400 metres. Amongst these only 8 were Swiss, 93 were Italian labourers, and the remainder mostly Russians and Poles. These eight Swiss are equivalent to 0·15 per thousand of the population of Zürich and its environs. The disease never assumed a malignant form, and was soon cured. Bauer never observed Goldzieher's "post-blennorrhœic Trachoma," although blennorrhœa was very common. The Italian workmen, with their national exclusiveness and reserve, do not cause any great danger of transmission of infection.

The amount of Trachoma in Berne[2] is only 0·03 per thousand, excluding foreigners.

France does not belong to the definitely trachomatous countries; only individual areas are specially affected—*e.g.* the province of Languedoc on the Gulf of Lyon—whilst the whole central plateau is practically free. The statistics for Paris[3] give 17 per thousand.

It is difficult, however, to believe that the Celtic races enjoy relative immunity, as Chibret of Clermont thinks. The Irish, for example, belong to the purest Celtic stock, yet they suffer considerably from Trachoma. After the Napoleonic wars many patients with Trachoma were found in French hospitals by English and German surgeons—*e.g.* Adams and Graefe—while French doctors declared that France was free from the disease. It is none the less a fact that widespread epidemics have not been observed in the French army since Napoleon's Egyptian campaign, and the disease then occurred almost entirely in sporadic cases.[4]

Even at the present time Trachoma is very rare among the French troops[5]; in fact, it scarcely occurs at all, presumably because the strictest care is taken to reject all

[1] *Bauer*, Korrespondenzblatt für Schweizer Aerzte 1900, No. 9.
[2] *Hirschberg*, Deutsche med. Woch. 1897, S. 3.
[3] *Hirschberg*, ibid. S. 11.
[4] *Eble*, loc. cit. S. 25.
[5] *Marvaud*, Les maladies du soldat. Paris 1894.

infected recruits.[1] Judging from the reports of the clinics, it occurs amongst the civil population with nearly the same frequency in France as in Germany.

On the other hand, the disease is still very prevalent throughout *Belgium*. It is extremely common in the low-lying provinces of Antwerp, the two Flanders, part of Limburg, Brabant, and Hennegau, while the higher districts, Liége, Namur, and the other part of Limburg, as well as the coast, are almost free. Between 1881 and 1890 scarcely any decrease was observed.[2]

Statistics[3] give for Brussels, 80 per thousand; Louvain, 140; Antwerp, 100; Tournay, 140; Mons and Namur, 50; Courtray, 800; and the province of Limburg, 278.

The Belgian army at the present time shows relatively little disease. After the experience derived from 1834 *sqq.*, prophylactic measures were rigidly enforced[4]—*e.g.* every soldier was made to carry his own wash-basin on his knapsack. Those who had the disease received no furlough—they were not even permitted to go out. Their eyes were inspected every week, and bad cases were at once isolated in hospital.

The following are the statistics for the Belgian army[5]:—

1890 .	0·98 per thousand.	1896 .	0·66 per thousand.
1891 .	2·53 „ „	1897 .	0·65 „ „
1892 .	1·57 „ „	1898 .	0·89 „ „
1893 .	1·54 „ „	1899 .	0·78 „ „
1894 .	0·99 „ „	1900 .	0·67 „ „
1895 .	0·64 „ „		

In 1855, on the other hand, there were 30 per thousand; 1850, 111; 1845, 166; and 1840, 200.[6]

[1] *Lawrentjew*, Wojenno-medizinski Journal 1892. Roth's Jahresbericht 1892, S. 111.

[2] *Deneffe*, Enquête sur l'état de l'ophthalmie granuleuse en Belgique 1891 and L'ophthalmie granuleuse en Belgique 1893.

[3] *Chibret*, De l'immunité de la race celte vis-à-vis du trachome. Verhandlungen des X. internat. mediz. Kongresses, Bd. IV. 10 Abt., S. 26.

[4] *Cohn*, loc. cit. S. 144.

[5] Statistique médicale de l'armée belge 1890—1900.

[6] *Kirchner, M.*, Grundriss der Militär-Gesundheitspflege. Braunschweig 1896, S. 452.

Holland is less affected than Belgium. It is worst among the coast provinces. The average is stated to be 40 per thousand (!) of the population.[1] During the last decades an appreciable decrease is said to have been observed, at any rate in Amsterdam.[2] Here among the Jewish population in 1875 Trachoma patients amounted to 440 per thousand of all eye diseases; in 1896 only 147.

In *Great Britain*, where Trachoma was prevalent as far back as the eighteenth century,[3] it spread very widely after the Egyptian campaign against Buonaparte, but diminished considerably afterwards. It is still found in some parts of England, more frequently in Scotland, and most of all in Ireland.

According to the account of Sydney Stephenson[4] in 1895, the number of Trachoma patients in England averaged 6, in Scotland 9, and in Ireland 26·4 per thousand of all eye patients.

In the British army, where general conscription is not yet introduced, the disease practically never occurs now.

Denmark and *Scandinavia*, in contrast with Finland, have very few cases. According to van Millingen,[5] the number in Sweden and Norway amounts to only 2·3 per thousand of the population, and in Denmark to 2·5. On the other hand, the Scandinavians in North America[6] show a very marked predisposition to Trachoma.

With regard to *Asia*, we have seen that the disease is very widely distributed over Siberia. In the Trans-Caspian region, among the Turcomans, Didanskaja[7] found it endemic and widespread; even children one or two years old showed trachomatous cicatricial entropion.

In Smyrna,[8] in Asia Minor, where van Millingen

[1] *van Millingen. Bach*, loc. cit. S. 20.
[2] *Jitta*, Nederlandsch Tijdschrift voor Geneeskunde I, S. 801.
[3] *Eble*, loc. cit. S. 66.
[4] Zentralblatt für prakt. Augenheilkunde 1898, S. 31.
[5] *Bach*, loc. cit. S. 20.
[6] *Ole Bull*, Zentralblatt für prakt. Augenheilkunde 1896, S. 324.
[7] Nagel's Jahresbericht 1897, S. 88.
[8] *Schmidt-Rimpler*, loc. cit. S. 9.

examined the schools, the disease is commoner than in Constantinople.

For very interesting researches on the condition of Syria and Palestine we are indebted to Th. Germann, of St. Petersburg, who travelled through these countries in 1896 as a commissioner from the Russian Orthodox Palestine Society.[1]

In *Palestine* one is immediately struck with the great number of people suffering from eye disease as well as professional blind beggars. Germann did not observe any eye disease peculiar to this country, but found forms of conjunctivitis — either acute or chronic catarrh or Trachoma—extremely common, kept up by filth, poverty, dust, lack of water, etc. Climatic conditions, as well as local individual and social circumstances, are set down as causes. For a period of at least six months, from May to October, there is no rain, whilst the burning sun beats down from an ever cloudless sky. It is only in the neighbourhood of the few springs and brooks that a very meagre vegetation can live. Great clouds of dust rise from the chalk and clay of the soil. The native population, both in the towns and in the country, are excessively dirty in their persons, clothing, and trades. An extenuating circumstance may be found in the deplorable absence of water. The agricultural population is extremely poor, lazy, stupid, and fatalistic. Their chief food consists of different kinds of fruit, which they cover with a thick cloth to keep off the dust and dirt. Peaches, apricots, cactus, wine, melons, pomegranates, figs, water-melons, dates, bananas, oranges, sweet citrons, mandarins, eaten without being cleaned, together with bread, oil, and a little vegetable, form the staple food. The fine prickly hairs which cover the cactus fruit, fig juice, and the multitudes of flies cause and disseminate the disease, according to popular belief. Germann admits this only in so far as the flies cause the people to put up their dirty hands to their

[1] *Germann*, Zentralblatt für prakt. Augenheilkunde 1896, S. 386 ff.

eyes or to their faces, which are smeared with the sweet juice of the fruit they have eaten. The Arab peasants, fellaheen, Bedouin, Turks, and Jews are all conspicuous for extreme uncleanliness. The dirt from the fruit is transferred from their hands to their eyes, and this is held by Germann to be the usual mode of infection. Possibly, too, many eyes are infected by the wind and dirty trades. He does not attach much importance to the flies as direct carriers of infection. That the shocking filthiness of the people is the chief cause of the extraordinary amount of eye disease is proved by the fact that foreigners who are living in the country escape. Interesting evidence of this is further shown by the result of the inspection of schools in the large German colony of Caifa—not a single case of Trachoma among 103 scholars. Numbers of native children suffer from acute or chronic catarrhal conjunctivitis, often in addition to Trachoma. "Eyelashes matted together, dry scabs on the margins of the lids and upper part of the cheeks, masses of yellow muco-purulent discharge at the inner canthi, . . . a dirty face, filthy nose and hands, and very often eczema of the scalp. Flies settle on their lids, nose, lips, and head, only to be driven away when they become too troublesome. Their clothing is wretched and always dirty." The stricter the attention directed to cleanliness in schools, the better was the condition of the children's eyes. From May to December, during the hot season, the children do not go to school. When the heat diminishes and the rain comes, eye complaints become much less frequent.

Trachoma, which is seen only in chronic form with large granulations, is a national scourge in Palestine. It is met with in all phases, and is followed by the whole gamut of sequelæ—pannus, simple, adherent, and total leucoma, partial and complete anterior staphyloma, secondary glaucoma, entropion, trichiasis and distichiasis, and xerophthalmia. Germann did not see a single case of acute Trachoma or of so-called follicular conjunctivitis. The

disease occurs frequently even amongst babies, and the mothers were always suffering from it. The country people take it more frequently than those living in towns, and women more often than men. The wife occupies a very unworthy position, and shameless advantage is taken of her power to work.

The indescribable filth of the people, coupled with their laziness and indolence, favour the spread of infection from person to person, and render the use of any treatment futile. Frequently whole families suffer from the disease, the older members being unfitted for work.

In *Syria* eye disease, including Trachoma, is not so common as in Palestine, and Germann observed many mild cases of old Trachoma without any serious loss of vision. The land is richer, the people live better, especially in Lebanon, where they have their own government, and do not labour under Turkish officialdom. Spring or river water is abundant everywhere; there is more vegetation, and there is less dust during the dry season. In Syria there is more rain and the thunderstorms begin earlier.

In the Syrian schools the eye patients amounted to 38·68 per cent., including 15 per cent. Trachoma; in the schools in Palestine the numbers were 60·67 per cent. and 51·18 per cent. respectively. Corneal complications occurred in 12·62 per cent. of the cases in Syria, and in 24·77 per cent. in Palestine; but pannus proper during the school period occurred in only 6 per cent. and 9·62 per cent. respectively.

Germann, who used the mechanical or surgical treatment of Trachoma, considers that under the conditions which have been described, the main object to aim at is prophylaxis, and especially the improvement of domestic circumstances. "We can only help the rising generation, and educating them to cleanly habits and self-respect is by far the most important lesson in prophylaxis. The less infection among the mothers, the less disease among the children." [1]

[1] *Germann*, loc. cit. S. 402.

Arabia, with its lack of water and its African climate, intense heat and drought in the uplands alternating with raw, cold weather, is stated by Falk [1] to be a hotbed of Trachoma, the propagation of which is favoured by the pilgrimages to the sacred cities of Mecca and Medina. Nearly one-fifth of the population suffer from defective vision.

Mesopotamia and *Persia* are also said to be overrun with the disease, which even invades the higher altitudes in the latter country. It is impossible to obtain any statistics.

As regards *India*, Trachoma is more prevalent in Bombay than in Calcutta [2] (100 to 60 per thousand of all eye diseases), whilst, in spite of the heat, Ceylon is said to escape.

In *Central Asia*, according to van Millingen, Trachoma occurs in 900 per thousand of the population, the highest proportion yet obtained.

In *the East Indian Archipelago*, among the Malay population of the Sunda Islands, the disease is said to be moderately prevalent. In Java, Kessler [3] found 34 per cent. of the European children in Semarang with Trachoma, which he attributed to the "slendang," or carrying cloth, of the Java nurses: it serves to wipe the nose and eyes of both nurse and child, and is rarely washed, because it is made of costly material (*batik*).

China and *Japan*, the countries of the Mongol races, are no less hotbeds of Trachoma. In Canton the proportion is as high as 700 per thousand, and in Tokio 140.[4] Y. Onisi [5] states that 250 per thousand eye cases are Trachoma, and of these 25·4 per cent. have pannus, a complication which

[1] *Falk*, Nagel's Jahresbericht 1873, S. 179.

[2] *Hirschberg*, Ueber die körnige Augenentzündung in Ost- und Westpreussen. Jena 1897, S. 13.

[3] Zeitschrift für Augenheilkunde, Bd. V. S. 70.

[4] *Hirschberg*, Ueber die körnige Augenentzündung in Ost- und Westpreussen. Jena 1897, S. 13.

[5] Zentralblatt für prakt. Augenheilk. 1897, S. 189.

only comes on very late. He observed the disease at all ages in the academic eye clinic of Okayama, but most frequently between 15 and 30. It was commoner among men than women—58 per cent. and 42 per cent respectively. According to Mujakita,[1] 750 per thousand eye patients in Japan have Trachoma. Yarr considers that the slit-like character of the palpebral fissure in the yellow races has something to do with their extraordinary susceptibility.

Among the Chinese the spread of the disease is favoured by their habit of going every morning to the barber to have their lids combed and brushed.[2]

In *Australia* Trachoma is chiefly introduced by immigrants.[3] The author has been unable to ascertain whether the Malays suffer most in this country also.

Trachoma is extremely common in Africa. *Egypt*, the classic home of the disease, the land of eye sufferers and the blind, has been visited in recent years by many well-known ophthalmologists. All are agreed as to the extraordinary amount of eye disease and blindness. On the Lower Nile ophthalmia is said to be common even among horses, oxen, sheep, and dogs.[4] Pruner, a native of the Palatinate, who was a professor in Cairo, director of the hospital, and court physician from 1831 to 1860,[5] states in his *Krankheiten des Orients* (1847) that eye affections are spread throughout all Oriental countries except the deserts: in Upper Egypt they are very common, in Lower Egypt they are proverbial. He says that very few natives have normal eyes in the Delta. Conjunctival complaints are endemic, and become epidemic, like dysentery. In 1836, during the war with the Turks, 3,000 soldiers constantly had eye troubles, and in the course of the whole summer the number amounted to 20,000.

Hirschberg, who made a tour through Egypt in February

[1] Zeitschrift für Augenheilkunde, Bd. III. S. 179.
[2] *Falk*, loc. cit.
[3] *Hirschberg*, Ueber die körnige Augenentzündung, etc. S. 13.
[4] *Eble*, loc. cit. S. 63.
[5] *Hirschberg*, Aegypten, S. 108.

and March, 1889, examined all the in- and out-patients in the Arab hospital at Alexandria, and found chronic Trachoma and its results as a regular concomitant among the Egyptians; it was also prevalent in the schools. On the other hand, the doctors there state that Europeans and the majority of Levantines escape. Tachau, who practised as an ophthalmic surgeon for nearly thirty years in Egypt, and died in 1895, had no fewer than 750 cases per thousand, in spite of the fact that many of his patients were Europeans. Hirschberg[1] writes: "Just as Goethe's traveller heard everywhere the same song, so we are confronted at every step of the journey from Alexandria to the borders of Nubia with the wretched state of the people's eyes. At every station where the train stops between Alexandria and Cairo, we see red and photophobic eyes; one-eyed people, who sometimes wear a glass bead as a charm hanging from the fez over the blind and shrunken globe; the considerable number of totally blind people . . . The same is seen at every place where the Nile steamer stops—Assiout, Luxor, Esneh, Assouan, and the Nubian frontier. So too in every small village." The dazzling light from a cloudless sky, the tremendous heat, the hot south wind or sandstorm (*chamsin*), the dust from the desert, and the suppression of perspiration owing to the cool nights and the dew, were, he says, previously held to be causes of the disease. This view, however, is disproved by the fact that the Bedouin in the desert are almost free from it, like the Nubians and Soudanese who live in Egypt. Chamseru, in a report on the National Convent, proved that the effluvia from the Nile and its canals cannot be the cause of Trachoma, for among all the French merchants who lived by the city canal in Cairo, not a single one was made blind in a period of fifty years. Neither will Hirschberg accept the view held by Griesinger, Koch, Virchow, Schmidt-Rimpler, Howe, and Eloui Bey, that flies carry the infection. He thinks, however, that there

[1] *Hirschberg*, loc. cit. S. 113.

can be no doubt that when the Nile overflows its banks, the disease becomes commoner, and that among the European troops those encamped on the Mareotis marsh suffered most. Hirschberg gives a rather pessimistic opinion as to stamping out this Egyptian scourge. If it is possible at all, the attempt should be begun amongst the school children.

Fuchs[1] wrote in 1894 that probably not a single person among the poorer classes in Lower Egypt remains free from the complaint. Up the river it becomes distinctly less frequent and less severe; probably the comparative immunity of the black races has something to do with this. The slight ptosis of Orientals, so well known among painters, is due to Trachoma. The disease in Egypt is distinguished from that met with in Europe only by the vast numbers that suffer from it at all ages, and by the frequency of panophthalmitis. Fuchs observed cases cured after a mild attack, cases with papillæ and few granulations, scarcely a case with granulations only, and cases of cicatrised Trachoma and its results, especially corneal ulceration and panophthalmitis.

In the spring of 1898 Schmidt-Rimpler[2] saw over 100 cases of Trachoma in one morning at the out-patient department of Kenneth Scott's clinic at the Kasr el Aini in Cairo. Nearly all these cases were in the cicatricial stage, and in extremely few could Trachoma bodies be seen in any considerable numbers. Among the patients in other departments of the hospital, too, he saw scarring very often. He thinks it probable that the disease is carried by flies. Further, the fine sand produces severe irritation of the conjunctiva, and facilitates infection. In view of the conditions prevailing in Egypt and the wide distribution of the disease, he thinks it not altogether impossible that infection may be carried by the wind. He observes that van Milligan found 3,200 cases of Trachoma among 4,000 Egyptians, or 800 per thousand.

[1] *Fuchs*, Wiener klinische Wochenschrift 1894, No. 12.
[2] *Schmidt-Rimpler*, loc. cit. S. 7.

Morax and Lakah report in 1901 that it is almost impossible to evert the lids of native Egyptians without finding Trachoma. In the native schools of Alexandria 80 to 93 per cent. of the children suffer from it. The infection generally occurs within the first few years of life through the mother or nurse, and to some extent also in the schools. The influence of climate and race is indefinite, for European children living under similar conditions catch the complaint.

Leopold Müller,[1] a pupil of Fuchs, spent May and June, 1898, in Egypt for the purpose of determining whether the bacillus which he had discovered (*v. infra*) had any ætiological significance in Trachoma. He too was only able to establish the fact that the disease is pandemic among the natives. Infection occurs ordinarily before the third year of life, and in most cases during the first. All adult Arabs have cicatrices. The disease has a very chronic and often mild course, probably due to onset during infancy and partial hereditary immunity. Many can be easily cured without the appearance of complications. The severe annual epidemic during the season of inundation in August and September is, he states, not due to Trachoma, but to "conjunctivitis acuta contagiosa," set up by the Koch-Weeks bacillus. This was first described by an Arab doctor, Saad Sameh, who had no knowledge of bacteriology, and called it "la conjonctivite suraigue." L. Müller prefers to call it "Egyptian catarrh," from its great frequency there. Besides this type, acute gonorrhœal ophthalmia, which occurs much more frequently than in Germany, is also said to contribute to a slight extent to the summer epidemic. Mixed forms of Trachoma with either Koch-Weeks or gonorrhœal conjunctivitis, or both together, are very common. On the other hand, Müller observed remarkably few cases of phlyctenular conjunctivitis, or other forms of conjunctivitis complicated with phlyctenules, in spite of the filthy condition of the

[1] *L. Müller*, Archiv für Augenheilkunde, Bd. XL. S. 13.

fellaheen children. A conjunctiva showing Trachoma scars reacts much less to the bacteria of other diseases—*e.g.* the gonococcus or Koch-Weeks bacillus. Owing to the shortness of his visit to Egypt, Müller was unable to ascertain how often a trachomatous pannus was improved by an intercurrent attack of gonorrhœal ophthalmia. Moreover, the poorer Arabs apparently attach little importance to the acuity of their vision. They either see or they do not see—*i.e.* it is much the same to them whether they can distinguish figures at a few metres or have approximately normal vision. As regards the flies, there is a popular idea that they must be allowed to rest on the children's eyes, because they eat up the disease—*i.e.* the purulent discharge.

A. Osborne,[1] who succeeded Tachau as surgeon to the eye department of the European Hospital at Alexandria in 1895, after five years' work confirms the fact that every Arab shows traces of Trachoma. The number attending his polyclinic daily amounts to from 100 to 250; the greatest number come in August. Most of the operations which he has performed for the sequelæ of Trachoma have been for trichiasis—471 in five years. Among the alleged causes of the disease—the dazzling light, heat, dust, chamsin, Nile floods, etc.—he lays stress on the temperature in so far as dust and flies are dependent upon the increasing heat and the longer duration of the rainy season. The dust must be regarded as more than a predisposing factor. It can carry infection only when it is infected through dense crowding together of the people; whilst the dust of the desert, though it can certainly set up mechanical irritation, being free from contagion, cannot produce purulent inflammation. Hence the Bedouin, who live in the desert, suffer much less than the inhabitants of the thickly populated Delta or its large cities. The flies, too, must perhaps be taken into account as carriers of infection. At the same time it must not be forgotten that Trachoma, as well as the various endemic forms of conjunctivitis which become

[1] *Osborne*, Archiv für Augenheilkunde, Bd. XLII, S. 102.

epidemic every year, are pre-eminently diseases of the lower grades of society. The indescribable filthiness and overcrowding of the Arab population [1] are factors which indicate, perhaps more than the dust and flies, the direction in which the Government should take steps for stamping out an evil which has made Egypt notorious from time immemorial as the land of ophthalmia and blindness.

Mohamed Eloui Bey, formerly Professor of Ophthalmology in Cairo, and Chief Medical Officer of Health to the Government schools, at the first Egyptian Congress in Cairo in December, 1902, advocated the view that Trachoma is only contagious where there is discharge: he believes the chief carriers of infection to be flies, dust, and dirt.[2] He proves from statistics that in the last fifteen years (from 1888) Trachoma has diminished considerably in the Egyptian schools under improved hygiene and instruction of the scholars in cleanly habits. In 1888 the disease was present in 85 per cent. of the children, in 1902 in only 57 per cent. He strongly advocates the continuance of these hygienic reforms, as well as periodic inspection of the eyes of all school children. The splendid results which he obtained show brilliantly how encouraging a well-planned campaign against Trachoma is even in a country in which it is pandemic, and to how great an extent it is an avoidable disease.

General statistics as to the number of blind in Egypt have apparently not yet been made. In Cairo Brugsch counted four blind persons and sixteen with only one eye in one hundred new patients.[3]

When we turn from the Delta of the Nile towards the west, we find Trachoma spread over the whole of the north coast of Africa, and it is said to be common in the regions around the Senegal and the Niger.[4]

[1] *Osborne*, loc. cit. S. 102.

[2] *Mohamed Eloui Bey*, Contribution à l'étude de la granulation conjonctivale de sa nature et de sa prophylaxe dans les écoles. Caire 1902, S. 56.

[3] *Hirschberg*, Aegypten, S. 105.

[4] *Falk*, loc. cit.

More exhaustive accounts have been given of its distribution in *Tunis* and *Algiers*. According to the report of the French army surgeon Viger, in Zammorak, Algiers, 10 per cent. of the whole population in those parts have it, and 25 to 30 per cent. of the natives who come up for military service are unfit on account of this disease.[1] On the other hand, the French surgeon Gros reports from Oran that another form of conjunctivitis, "conjonctivite saisonnière," is commoner than Trachoma.[2] This form always breaks out in the hot season, September and October, chiefly attacks children, and always has an acute onset; when neglected it becomes chronic. It never heals spontaneously, but, unlike Trachoma, it is easily cured. The lids become thickened at a fairly late stage, the cornea is very rarely affected, and pannus never occurs. From the description this form seems to be similar to conjunctivitis due to Koch-Weeks bacillus.

According to Bruch (Algiers), Trachoma is endemic throughout Algeria, and is found among all races and nationalities.[3] Its frequency and severity depend on social and hygienic conditions; but in both respects improvement has taken place during the last few years.

Sagrandi[4] also stated in 1902 that there is a marked diminution in the amount of Trachoma in Algeria as the result of improved hygienic conditions. It is still very common amongst the resident inhabitants belonging to the lower classes, but very rare amongst the French soldiers. Among the nomads, too, it seldom occurs, from the fact that they live in the open and in the hills.

As regards *South Africa*, especially Cape Colony and the Transvaal, H. Lewkowitsch gave an account in 1897, after fourteen years' practice in these parts.[5] Among the

[1] Progrès medical 1892, No. 19-25.
[2] Zentralblatt für prakt Augenheilk. 1898 S 512
[3] Ibid. 1901, S. 271.
[4] Ibid. 1902, S. 307.
[5] Ibid. 1897, S. 253

Boers, nearly half his eye patients from the country had Trachoma, the older ones often in its most virulent and obstinate form. This is not surprising, for these superstitious people usually go on doctoring their eyes themselves for a long time, using secret remedies and homœopathic medicines, which they obtain from itinerant quacks. Lewkowitsch does not think that altitude and race have any influence on the spread of the disease. He found it very common at a height of 6,000 feet above the sea, and frequently among the Kaffirs and Hottentots. This is the more remarkable because the negroes of North America, according to Swan Burnett, enjoy a relative immunity, though they are descended from the African negroes. It is surprising that the sandstorms which often rage with great violence during the winter months in Johannesburg and other parts injure the eyes so little. "If one ventures out, for even a few minutes, the mouth, nose, and ears are filled with yellow dust, and it is actually impossible to see at all, for the eyes are completely choked up with dust." Even the dazzling brightness of the South African landscape, on which the sun burns down from an ever cloudless sky, is said to have no perceptible injurious influence.

Trachoma is widespread in many parts of America. In the *United States* its introduction is due to immigrants; Edward Davis[1] proved this by numerous statistics. After stringent laws were put in force by which trachomatous immigrants were not allowed to land, the disease showed a distinct decline, as is best proved by the statistics of the large clinics. The immigrants from Ireland and Scandinavia suffer much from the disease.

It is said to be specially prevalent along the Mississippi, and here as far back as 1825 epidemics of purulent ophthalmia were observed.[2] In the State of Illinois the disease occurs in 65 per thousand of all eye diseases.

[1] Zentralblatt für prakt. Augenheilk. 1902, S. 310.
[2] *Savage. Eble*, loc. cit. S. 75.

A. L. Adams[1] attributes the spread of Trachoma in country districts to the itinerant labourers, and the indolence of the people, through which it often happens that several members of a family lose their sight.

Pusey[2] saw great numbers of white men with Trachoma in West Kentucky, but very few negroes.

Gradle[3] draws attention to the fact that in some cases only one eye is affected, though the disease may go on for years. He found it extremely common amongst the Armenians who were employed in the wire factories at Waukegan (Illinois), and who lived in a colony by themselves.

Nelson M. Black[3] very rarely saw the disease in Milwaukee, on Lake Michigan, although there was a large foreign population in the surrounding country.

Gilfillan[4] found in the casual wards of a workhouse in New York 325 inmates with Trachoma out of a total of 800; he was able to prevent further spread by strict isolation.

H. B. Ellis has found from statistics that the percentage of Trachoma in South California varies between 0·5 and 1·0. He attributes this to the high coast level, as well as to good climatic, hygienic, and social conditions. Almost every nationality might be affected, but especially Americans. In Mexico the disease is commoner.

In Montreal, in *Canada*, Foucher[5] observed 499 cases of Trachoma among 13,865 eye patients—*i.e.* 36 per thousand. He holds that the disease is akin to tuberculosis, and lays stress on the complete immunity of the Esquimaux and Canadian Indians, in contrast with the earlier observations of Burnett on the frequency of Trachoma among the Indians of the United States. The Russian Mennonites

[1] Zentralblatt für prakt. Augenheilk. 1901, S. 398.
[2] Ibid. 1901, S. 398.
[3] Ibid. 1901, S. 398.
[4] *Horstmann*, Bericht über die Leistungen und Fortschritte der Angenheilkunde im Jahre 1897, S. 238.
[5] Zentralblatt für prakt. Augenheilk. 1897, S. 156.

in Manitoba, who live under very poor conditions, suffer severely from it. In Foucher's opinion a sea climate is protective.

From statistics which Swan Burnett[1] obtained from thirteen different parts of the United States, he emphasises the fact that the negroes are comparatively free from Trachoma, although they live under very bad hygienic conditions. In Washington, where a third of the population is composed of negroes, he found only 6 negroes with Trachoma among 10,000 patients in 15 years. White, of Richmond, saw it only once in a negro among 11,000 patients from a population largely made up of negroes. Savage, of Nashville, never saw it among the negroes, who compose 30 per cent. of the inhabitants, while it was common among the white people. The Indians in the United States often suffer from it. Altitude has no influence on the disease: it was observed 5,000 and even 10,000 feet above the sea level. Neither has latitude much effect.

There is little Trachoma in the United States army. According to the Surgeon-General's report,[2] the proportion was 0·34 per thousand in 1895, 0·04 in 1896, and 0·08 in 1897.

According to Yarr,[3] four white men and seven Chinese are seen in *Cuba* with Trachoma to one negro.

In South America, *Brazil* is seriously affected. It is said to have been introduced from the West African coast by slave ships.[4] European immigrants have also probably helped to spread it.

O. Wernicke[5] gives a similar account from Buenos Ayres. He says that Trachoma is fairly common in the *Argentine Republic*. This author believes that it was brought into the country principally in 1810, at the commencement of the decline of Spain, not only by Spanish

[1] Zentralblatt für prakt. Augenheilk. 1897, S. 156.
[2] Report of the Surgeon-General of the Army to the Secretary of War 1895-7.
[3] Nagel's Jahresbericht 1899, S. 170.
[4] *Falk*, loc. cit.
[5] *Wernicke*, Zentralblatt für prakt. Augenheilk. 1897, S. 169.

troops, but also by other European soldiers who emigrated to that country after the fall of Napoleon I. The proportion of blind people in this republic, which was very high in 1869—20·24 in 10,000—is said to have been the result of deterioration of the race, and to have since fallen, owing to the large number of immigrants, so that the proportion is now less than 10 to 10,000.

In *Bolivia*[1] Trachoma is rare: during a visit of several months Gaffron did not see a single case among 455 eye patients.

[1] Zentralblatt für prakt. Augenheilk. 1898, S. 160.

CHAPTER III

SYMPTOMS AND COURSE

In the preceding chapters we have used the term "Trachoma," which is the usual name for the form of conjunctivitis under discussion, and is understood by scientists throughout the world. Moreover, the term is so far satisfactory in that it is derived from the most prominent symptom—viz. the rough (τραχύς), uneven, granular condition of the conjunctiva.

We have already seen that the name "Trachoma" is of late date, having been first employed by Pedanius Dioscorides (60 A.D.), though not in the specific sense in which it is used to-day. Among the ancients we only find the expression τραχύτης, but it was not meant to denote anything more than the state of roughness, and was never used as a general term for the disease. For this the Greeks used ὀφθαλμία, a generic term which corresponded with the imperfect diagnosis of the time. It is found in the writings of Hippocrates, the Romans using the word "lippitudo" (from *lippire*, to be blear-eyed).

With the beginning of the new epoch in the history of the disease, dating from Buonaparte's expedition into Egypt, we find new terms—*e.g.* ophthalmia Ægyptiaca (Himly, Savaresi), ophthalmia purulenta chronica, and ophthalmia militaris seu bellica (Baltz). The last name has of course a much wider meaning than the Trachoma of the present time. The diagnosis of the latter affection was not fully worked out, and the descriptions given at

that time prove conclusively that gonorrhœal ophthalmia, as well as simple and follicular conjunctivitis, and probably also diphtheritic conjunctivitis, were included with Trachoma under the term ophthalmia militaris. Besides these names we also find conjunctivitis granulosa[1] (Saemisch, Mackenzie), taken from the granular appearance of the conjunctiva, which gives it a superficial resemblance to the surface of a granulating wound. The single word "granulose" has come into current use, especially in Eastern Prussia, and little objection can be made to it. Hirschberg has proposed the German word *Körnerkrankheit*. "Conjunctivitis contagiosa" is less expressive because too general; and from the present standpoint "conjunctivitis follicularis," used by the unitarians, is equally objectionable, leading only to confusion.

Turning now to the clinical picture of the disease which we call Trachoma, it may be defined as a specific contagious form of conjunctivitis, extremely chronic, lasting months and years, and, when left to itself, causing serious and permanent impairment of vision, and frequently even total blindness. We need not give here an exhaustive account of the various ideas which have been held as to the nature of Trachoma during the last century. The result of endless discussion has been to narrow down and more sharply delimit the disease.

In the first decade of last century the question arose as to whether Trachoma was contagious or not. This point will be dealt with more fully elsewhere. We learn next to nothing as to the pathological anatomy of the disease from the period when it was especially rife. The various forms in which military ophthalmia appeared were never analysed clinically or microscopically; blennorrhœa and Trachoma were hopelessly confused by all observers.

[1] The term "granulations" for the rough conjunctiva in Trachoma is first met with in *Vetch*, 1807, who does not give a satisfactory explanation of them. *Vetch*, Geschichte der Ophthalmie, welche in England nach der Rückkehr der britischen Armee herrschte. Aus dem Engl. übers. von *Michälis*. Berlin 1817, S. 34.

In 1828 Eble[1] held that the granulations were due to proliferation of the so-called "papillary body" of the conjunctiva, which he was the first to describe. In 1841 Carron Duvillard[2] compared them with chilblains; Himly,[3] in 1843, took them for clusters of sarcomata; Hasner[4] (1847) and Sotteau thought they were an eruption of vesicles; Lawrence[5] (1850) took them for real fleshy warts; Ruete[6] (1854) for plastic exudates in the submucous tissues; Thiry[5] for heteromorphous growths "analogous to those observed on the cervix uteri"; and Pilz[7] (1856) for gelatinous exudations.

Bendz[8] was the first to throw some light on the matter in his treatise which appeared in 1858. He distinguishes between (1) the papillary swelling, and (2) the specific disease, which has its seat in the follicles. These are similar to the follicles in the intestines, and cause the granulations. These he calls "glandular" granulations, as opposed to the "papillary" variety, which never occur in the catarrhal form of ophthalmia militaris, but only in the blennorrhœic and "trachomatous" forms. According to him, this ophthalmia has no constant clinical appearances, but presents itself sometimes as catarrh, and sometimes as blennorrhœa or granular conjunctivitis.

Arlt,[9] in 1860, treated Trachoma as a separate disease, and denied its identity with contagious or Egyptian ophthalmia. In 1881, however, he includes all cases that had

[1] *Eble*, Ueber den Bau und die Krankheiten der Bindehaut des Auges mit besonderer Beziehung auf die kontagiöse Augenentzündung. Wien 1828.

[2] *Decondé*, Mémoires sur differentes questions, qui se rattachent à l'ophthalmie de l'armée. Bruxelles 1841.

[3] *Himly*, Die Krankheiten und Missbildungen des menschlichen Auges. Berlin 1843.

[4] *Hasner*, Entwurf einer anatomischen Begründung der Augenkrankheiten. Prag 1847.

[5] *Hairion*, Anatomie pathologique des granulations palpebrales. Bruxelles 1850.

[6] *Ruete*, Lehrbuch der Ophthalmologie. Braunschweig 1854.

[7] *Pilz*, Lehrbuch der Augenheilkunde. Prag 1856.

[8] *Bendz*, Compte rendu du congrès d'ophthalmologie. Paris 1858.

[9] *von Arlt*, Die Krankheiten des Auges. Prag 1860.

been previously described as Egyptian, military, granular ophthalmia, and Trachoma under the term "chronic blennorrhœa." Granulose, he says, is not a disease *sui generis*, but only a modified form of blennorrhœa, primarily set up by discharge conveyed from the genitals to the eyes.

In 1870 Stellwag von Carion[1] distinguished several forms according to the variety of the deposits on the conjunctiva: the pure granular, the papillary, the mixed, the diffuse, and a secondary or gelatinous form that arises from the mixed or the diffuse.

Saemisch,[2] in 1876, made a sharp distinction between follicular conjunctivitis and conjunctivitis granulosa or Trachoma.

It would take us too far to enter fully into the host of different opinions which have been held about Trachoma. There are so many contradictions, so many different names for the same thing, or different meanings for the same words, that nothing would be gained by enumeration. Fuchs,[3] *e.g.*, who distinguishes a papillary and a granular form, calls the latter, which is characterised by Trachoma-bodies, Trachoma verum, Trachoma Arlti, Trachoma folliculare (Horner), or speaks of "granulations," whilst others use this term for the papillary form. It would be useless to mention all these contradictions, or to attempt a new classification. It is enough to draw attention to the fact that since the development of bacteriology the blennorrhœic group or gonorrhœal ophthalmia has been separated from the diseases included under Trachoma. The catarrhal forms of conjunctivitis had already been differentiated, but the differentiation of follicular conjunctivitis, for which Saemisch was mainly responsible, was for a time rejected by the unitarians. It is only recently that it has again found fairly general

[1] *Stellwag von Carion*, Lehrbuch der Augenheilkunde. Wien 1870.

[2] *Graefe-Saemisch*, Handbuch der gesamten Augenheilkunde, Bd. IV. Leipzig 1876.

[3] *Fuchs*, Lehrbuch der Augenheilkunde 1898, S. 91.

acceptance, resulting in the victory of the dualistic theory at the present time.

Nevertheless, the clinical aspects of Trachoma, and still less its anatomy and ætiology, have not yet been sufficiently clearly expounded. Much remains to be elucidated about the purely catarrhal, the blennorrhœic, and the follicular forms before we shall be in a position to recognise the specific contagious disease, with a distinct and definite ætiology. It is to be hoped that this end may be attained by the aid of bacteriological research.

In order to understand the pathological anatomy of the disease, it is necessary to give a short *résumé* of the normal anatomical structure of the parts. The conjunctival sac is open only anteriorly at the palpebral fissure; it is divided into three parts—the conjunctiva of the lids, of the fornices, and of the globe. The palpebral conjunctiva, which, like that of the fornix, is covered by cylindrical epithelium, is firmly attached to the tarsus. At birth it is quite smooth and possesses no adenoid layer. In the second or third month[1] after birth the conjunctiva of the lids and fornices shows signs of adenoid tissue in a diffuse infiltration with lymph cells and the formation of microscopic follicles. As this appears and gradually increases, the conjunctiva becomes folded, and the so-called papillary body, described by Eble, is formed, a great ramifying system of furrows (Stieda[2]) alternating with low ridges. In the palpebral conjunctiva tubular glands (Henle's glands) are found, and in the fornices the acinous glands of Krause.

The ocular conjunctiva is covered with pavement epithelium, possesses no adenoid tissue, and is bound to the globe by loose episcleral tissue, forming the semilunar fold at the inner canthus.

The nerves are derived from the trigeminal. The blood-vessels of the palpebral conjunctiva arise from the perforating branches of the tarsal arch and the palpebral arteries,

[1] *Raehlmann*, von Graefe's Archiv, Bd. XXIX. 2, 1883.
[2] *Stieda*, Archiv für mikroskopische Anatomie, Bd. III. 1867.

while the blood supply of the ocular conjunctiva is derived partly from the palpebral arteries and partly from the anterior ciliaries.

In text-books we usually find Trachoma divided into acute and chronic. The most important and characteristic sign of trachomatous conjunctivitis is the presence of so-called Trachoma bodies or follicles, around which there is a distinct diffuse infiltration of the adenoid tissue. The disease gives rise to secondary changes, especially to the formation of scarring.

In acute Trachoma the formation of follicles begins with symptoms of severe conjunctivitis—viz. much redness and swelling, lacrymation, and in most cases pericorneal injection. The follicles are at first formed only on the palpebral conjunctiva, especially in the neighbourhood of the fornices and the outer canthi. Their development can be best studied in the conjunctiva of the upper tarsus, where they look at first like deep grey or yellow specks as large as a pin's head—the so-called primary, elementary, or crude[1] granulations. These grow and become prominent after a few days or weeks. A moderate swelling of the normal conjunctival folds—the papillary body—follows, and this is frequently so great as to obscure the follicles and render diagnosis difficult, or even at first impossible. Corneal complications often occur in the form of small peripheral ulcers, less frequently as diffuse vascular opacity—pannus trachomatosus. In favourable cases the conjunctiva may be restored to its normal condition in a few weeks after the resorption of the follicles, or the disease gradually passes into the chronic form.

In chronic Trachoma three stages may be distinguished (Raehlmann)—the development of the follicles, their destruction, and the process of cicatrisation.

At the commencement of the first stage,[2] the stage of development and growth of the follicles, there is frequently

[1] *Schmidt-Rimpler*, Augenheilkunde und Ophthalmoskopie. Leipzig 1901, S. 430.

[2] Cf. *Rählmann*, loc. cit. S. 86 f. and *Germann*, Inaug.-Diss. Dorpat 1883, S. 22.

nothing to be seen about the eye externally. The process often goes on for some time in one eye only, the other not being affected for weeks, months, or even years, or in rare cases not at all. The palpebral conjunctiva shows some redness, slight swelling, and either a quite smooth surface or a little papillary hypertrophy on the upper tarsus. In the tarsal conjunctiva and fornices the rudimentary follicles above mentioned—"the crude or primary granulations"—can be seen, especially with the help of a lens. The subjective symptoms are slight; a few flakes float about in the lacrymal secretion.

The process may remain in this initial stage for several months, until these primary or elementary granulations gradually develop into full-formed follicles or so-called Trachoma bodies; these become more marked, and acquire their characteristic appearance. The development of the follicles is usually slow: they grow in distinct rows in the region of the retrotarsal folds, or scattered here and there, or in small groups in these folds and the tarsal conjunctiva. Primary deposits and follicles of different sizes are often seen beside one another in the same eye. The inflammatory symptoms gradually increase, some œdema of the lids and ptosis appear, the edges of the lids lying tightly apposed to the globe. The follicles are found quite over the mouths of the Meibomian glands, and are larger towards the retrotarsal folds. These show large transverse folds filled with granules, besides marked papillary swelling, so that on eversion of the lid thick, firm masses project. The so-called papillæ are dark red, flesh-coloured, or raspberry-like opaque bodies, having at first the appearance of close-cut velvet. They may ultimately develop into larger cockscomb-like growths, whilst the fully formed follicles are round or oval greyish red or greyish yellow bodies, like frogs' spawn or sago grains. They are frequently arranged in rows like a string of pearls. There are very few vessels in their interior, but they are often surrounded by a rich network of blood and lymph vessels.

The palpebral conjunctiva is much congested, while the lashes are matted together by the flaky or viscid discharge. The semilunar fold and caruncle are swollen and injected; the ocular conjunctiva is also much congested, and at times shows a few follicles here and there. There is an increase of subjective symptoms—viz. burning and pricking pain, gumming together of the lids in the morning, ptosis, lacrymation, more or less photophobia, and impairment of vision. The lid margins are often inflamed, and the cornea may become affected in this stage with typical pannus, which invariably begins at the upper margin, or diffuse superficial opacities, more rarely phlyctenules and superficial ulcers, may occur. In some cases the cervical and even the axillary glands may be swollen. The process may remain in this stage for months, and then gradually retrogress without any sudden change.

The second or degenerative stage, with breaking down and ulceration of the follicles, is ushered in by increased swelling and thickening of the conjunctiva due to diffuse lymphoid infiltration of the adenoid tissue. The follicles become confluent, and are no longer visible as projecting granules on account of the intense general infiltration. They now appear as round yellowish spots in the midst of the tightly stretched conjunctiva, which is but slightly injected, and in about two-thirds of the cases firm and gelatinous, dirty yellowish red in colour. The papillary swelling has now diminished, scarcely any trace remaining. The ocular conjunctiva is much congested, opaque, thickened, and discoloured. The surface of the follicle has broken down, and on pressure the softened contents protrude in the form of a comedo-like plug. There are often minute depressions, and small, thickly packed, crateriform ulcers at the sites of the follicles. The congestion again increases, and the surface may present the appearance of a granulating wound. Many of the follicles, like the surrounding adenoid tissue, undergo transformation into dense fibrous tissue. The secretion has now also increased, and is no longer mucous and flaky, but purulent

and, as we know from experience, intensely infectious. At this time several phases of the disease may frequently be seen simultaneously in the same eye, especially fully formed follicles, small crateriform ulcers, and commencing scarring. In the second stage the upper lid is usually more affected than the lower: the process is still in full activity in the former when it has already nearly passed off in the latter, or perhaps entered the cicatricial condition. Possibly absorption of the inflammatory products is favoured in the lower lid by the fact that the conjunctiva is less stretched and folded, and that it remains relatively at rest.

The subjective symptoms in the second stage are distinctly more marked, and complications are more frequent and severe. Besides the inflammatory changes at the margins of the lids, the tarsus has become more or less involved; moreover, the pannus has reached its greatest development, and has led in many cases to softening of the cornea, which bulges either partially or completely as a result of the intraocular pressure (keratectasia e panno). Phlyctenules and corneal ulcers are very common, and in about 90 per cent. of the cases vision is impaired. The palpebral fissures are narrowed, the lacrymal ducts become more and more implicated, the puncta lacrymalia, especially the lower, becoming reduced in size, obliterated, and everted, whilst the semilunar fold and caruncle are blended together into a single gelatinous mass.

As the conjunctiva becomes more and more disintegrated and converted into fibrous tissue, the severe inflammatory symptoms die down, and the process merges into the third stage, that of cicatrisation. The actual trachomatous process thus ends in the conjunctiva being gradually transformed into connective tissue. The adenoid tissue is destroyed, the conjunctiva becoming pale, and the discharge mucous, viscid, and often stringy, or disappearing entirely. Not infrequently the edges of the lids are coated with a fine white foam, which collects into large flakes, especially

at the canthi; this represents the altered Meibomian secretion. In the retrotarsal folds the remains of gelatinous tissue often persist, surrounded by cicatricial bands, and under the scarred conjunctiva there are concretions and small cysts with pultaceous or fluid contents.

In the less advanced cases the cicatrices appear as spots, streaks, networks, or irregular strands, or the conjunctiva, especially in the fornix, presents a dull, bluish grey appearance, as if covered with a thin layer of milk. In severe cases the conjunctiva loses its characteristic shimmer and transparency, and becomes transformed into a tense, smooth, greyish white or greyish yellow mass of scar tissue. The upper tarsal conjunctiva shows a uniform depressed cicatricial surface with a tendon-like lustre (Arlt's scar streak), and from this fibrous processes radiate outwards. The contraction of the cicatrix leads to symblepharon, boat-shaped distortion of the tarsus, entropion, trichiasis and distichiasis, narrowing of the palpebral aperture, and extensive changes in the lacrymal apparatus. Dacryocystitis occurs relatively often—in about 5 per cent. of cases. The caruncle and plica semilunaris form a gelatinous band, or become unrecognisable; or the caruncle may be represented merely by a small yellowish granular nodule. The pannus disappears to a large extent in this stage, though the diffuse opacities that follow it remain; or, as frequently also in the second stage, there may follow leucomata, keratectasia or anterior staphyloma, iridochoroiditis, secondary glaucoma, or phthisis bulbi. In about 8 per cent. of the cases so-called xerosis ensues, with complete atrophy and drying of the conjunctiva. The ducts of the lacrymal [1] and other glands become obliterated by the cicatricial contraction, so that the mucous membrane is no longer moistened. The epithelium becomes dry, assuming a grey appearance like epidermis, and the same condition extends to the cornea, which becomes quite opaque.

[1] *Schweigger*, Handbuch der Augenheilkunde. Berlin 1885, B. 266.

As regards the frequency of these complications, observations from Dorpat [1] show affections of the lids—blepharitis, narrowing of the palpebral aperture, trichiasis and distichiasis, distortion of the tarsus, entropion and ectropion —in the first stage 29 per cent., in the second stage 61 per cent., in the third stage 69 per cent.; affections of the lacrymal apparatus—inflammation of the semilunar fold and caruncle, narrowing, obliteration, or malposition of the puncta, dacryocystitis—in 17 per cent., 61 per cent., 64 per cent. respectively; affections of the cornea—pannus, phlyctenules, opacities, ulcers, leucomata, keratectasia, and anterior staphyloma—in 63 per cent., 98 per cent., 98 per cent.; symblepharon in 0 per cent., 13 per cent., 20 per cent.; impairment of vision in 55 per cent., 90 per cent., 94 per cent.; xerosis in the third stage in 8 per cent. of the cases.

Fortunately these complications and sequelæ occur much less frequently in cases which have been seen early and suitably treated, but in all cases in which the cornea is involved there is a great tendency to sudden exacerbation and relapse.

The histological structure of the follicles, which consist essentially of lymph-cells embedded in a fine meshwork of connective tissue, cannot be considered here in detail; for this the reader must be referred to the standard works of Wolfring,[2] Raehlmann,[3] Leber,[4] Villard,[5] and to the various text-books. Saemisch and Michel regarded the "Trachoma bodies" as new formations or lymphomata; Raehlmann as new-formed lymph-follicles. Leber found in them peculiar cells, the so-called *Körperchenzellen* or corpuscles, which contain numerous round granules and a faintly staining nucleus; they were described by Villard as phagocytes. Fuchs found also mast-cells.

[1] *Germann*, loc. cit. S. 80.

[2] *Wolfring*, von Graefe's Archiv, Bd. XIV. 3, 1868.

[3] *Raehlmann*, loc. cit.

[4] *Leber*, Bericht der 25. Versammlung der ophthalm. Gesellschaft zu Heidelberg 1896.

[5] *Villard*, Archives d'ophthalm. Bd. XVI. 1896.

Nearly all observers agree with the division into acute and chronic Trachoma, as given above. It is, however, generally admitted that the acute form is now very seldom seen as compared with the chronic. Schweigger,[1] for example, wrote in 1885: "The process may exceptionally run an acute inflammatory course; . . . as a rule it has a very chronic course"; and Michel[2] in 1890: "Trachoma often occurs in an acute form . . ."; and Hirschberg[3] in 1897: "The acute forms are much rarer [than the chronic], especially in this country. It is not improbable that they are due to a mixed infection, the germ of acute catarrhal conjunctivitis (short bacilli) being present in addition to the Trachoma germ." A. Roth[4] writes: "By this name [Trachoma] is understood a chronic endemic form of conjunctivitis, giving rise to the formation of follicles and scars, and endangering sight"; and, "Clinically Trachoma has seldom occurred in an acute form during the last decades." Raehlmann[5] describes Trachoma as "an extremely chronic disease, lasting for months and years." Greeff[6] writes in his *Studien über epidemische Augenkrankheiten* as follows: "The character of the disease has at the present time become much attenuated. Neither its onset nor its course is any longer so violent. Trachoma has become an extremely chronic disease; only slowly is one person after another affected—whenever an acute epidemic has been recorded, it has always been found to be a mistake—and its course is often prolonged for years."

One well-known fact is, however, worthy of mention—that acute Trachoma almost without exception attacks both eyes simultaneously; the chronic form, on the contrary, often attacks one eye, whilst the other remains well for years.

[1] *Schweigger*, loc. cit. S. 264.
[2] *Michel*, Lehrbuch der Augenheilkunde. Wiesbaden 1890, S. 204.
[3] *Hirschberg*, Ueber die körnige Augenentzündung, etc. 1897, S. 5.
[4] *A. Roth*, loc. cit. S. 197 und 201.
[5] *Raehlmann*, Klinisches Jahrbuch, Bd. IX. S. 634.
[6] *Greeff*, loc. cit. S. 58.

The tendency has recently become manifest for acute Trachoma in Germany to be limited to quite small areas. Junius,[1] who deserves special credit for his recent researches on the pathological anatomy of the disease, carried out on the extensive material of Kuhnt's clinic, emphasises the fact that cases are frequently diagnosed wrongly as acute Trachoma which are merely acute conjunctivitis of bacterial origin (usually pneumococcic) with formation of follicles, as well as cases of ordinary chronic Trachoma upon which an intercurrent attack of acute catarrhal conjunctivitis has supervened. Such an event often occurs, for the trachomatous, like the scrofulous conjunctiva, affords a suitable nidus for pathogenic organisms. Finally, a chronic Trachoma may be sometimes superadded to a simple acute conjunctivitis. All these cases are often in practice erroneously regarded as acute Trachoma. Kramsztyk[2] actually doubts whether primary acute Trachoma ever occurs.

Many different opinions are still rife as to the nature of the so-called "Trachoma bodies." Saemisch[3] regarded them as quite specific new formations, absolutely characteristic of Trachoma; but this view is not borne out by the most recent researches. He draws a sharp distinction between Trachoma and follicular conjunctivitis, and gives the following differential diagnosis: "Follicular conjunctivitis is characterised by the fact that catarrhal changes in the membrane are accompanied by the development of round, pale red, hemispherical bodies, which project above the surface and disappear at the end of the attack without leaving any trace behind. These bodies must be regarded as lymph follicles, since they completely agree in structure with such follicles. Granular conjunctivitis is characterised by the fact that the inflammatory changes in the conjunctiva are accompanied by the development of round,

[1] *Junius*, Zeitschrift für Augenheilkunde Bd. VIII. 1902, S. 124.
[2] *Kramsztyk*, Krytyka Lekarska 1878, No. 8, S. 221.
[3] *Graefe-Saemisch*, loc. cit. S. 29 und 39.

greyish red prominences, which invariably undergo a definite transformation, and very frequently lead to secondary changes in the cornea and the deeper parts of the lids (granulations)."

Kuhnt[1] gives the following definition: "Chronic granular conjunctivitis is characterised by the appearance of solid round bodies—granulations—in the tissue of the inflamed conjunctiva of the lids. These granulations must be looked upon as new formations, caused by the entrance of certain micro-organisms, of which the nature and specific action have not yet been conclusively established. The inflammatory changes in the surrounding conjunctiva must be regarded as the reaction of the tissue to these organisms."

At the present day, however, as the result of much histological research, the view is steadily gaining ground that the Trachoma bodies do not represent any specific pathological formation, but are simply true lymph-follicles, in so far as, according to modern ideas, a lymph-follicle in its simplest form is composed of an aggregation of lymph-cells in a reticulum, sharply circumscribed in the adenoid tissue in which it lies, and having a close relationship with lymph-vessels, though this is not always demonstrable.[2] The primary form of these structures, so far as they can be observed clinically, consists in small, well-defined clumps of lymph-cells scattered in the adenoid layer, especially in the upper tarsal conjunctiva, and appearing as yellowish white, scarcely raised spots, 0·2 to 0·4 mm. in diameter—the so-called primary or elementary granulations.

Since then these follicles are found in various other affections besides Trachoma—*e.g.* follicular conjunctivitis, atropin irritation, conjunctival tuberculosis and syphilis, leukæmia and pseudo-leukæmia—it seems certain that the conjunctiva responds to all kinds of irritation, bacterial and chemical, by forming a single inflammatory product,

[1] *Kuhnt*, Ueber die Therapie der Conjunctivitis granulosa. Jena 1897, S. 2.
[2] *Junius*, loc. cit. S. 84.

the follicle, which it is apparently specially prone to produce on account of the adenoid tissue which it contains. The specific importance of the Trachoma body or follicle is therefore no longer tenable; and although the clinical picture of Trachoma is admittedly subject to the eruption of follicles—with an additional diffuse infiltration of the subepithelial adenoid layer—yet the follicular eruption itself is not *per se* characteristic and specific, but only its exuberant subsequent course, accompanied as it is by permanent changes in the tissues. Whether the Trachoma bodies are merely pre-formed follicles which have become swollen, or are actually newly formed ones, is a question about which opinions are still at variance, in spite of repeated investigation and debate. The author believes that they are partly pre-existent and partly newly formed.

As regards the situation of the follicles, it must be remembered that the whole of the adenoid tissue is infiltrated with cells to a variable degree, and affords a suitable site for fresh deposits. As long as the follicles are superficial, they may become absorbed and entirely disappear. The more severe types of Trachoma are characterised by the very fact that the follicles are deeply placed, lying in layers and stretching the conjunctiva as they grow, thus leading to necrotic processes.[1] All the clinical manifestations of the disease, both at their onset and also for the most part at their height, depend upon the anatomical changes in the tissues, and especially upon those going on in the follicles.

According to Raehlmann, the commonest mode of disappearance of the follicles is by the expulsion of their softened contents after the epithelial covering has burst. More recent researches tend to show that the granules even more commonly pass through a process of fibrous degeneration and cicatrisation, as Raehlmann has also described.

[1] *Raehlmann*, Verhandlungen des X. internationalen medizinischen Kongresses, Bd. IV. 10 Abt. Berlin 1891, S. 19.

It has also been conclusively established that they are spontaneously absorbed, though rarely.[1]

It need only be mentioned that Blumberg[2] distinguished four stages in the development of the follicles—viz. growth, fatty degeneration, atheromatous degeneration, and atrophy or cicatrisation.

There is much difference of opinion about the capsule of the follicle. Most authors agree that it is scarcely ever quite closed. According to Blumberg, Berlin, and Iwanoff, it does not form an actual layer of the follicle itself, but is simply the surrounding normal connective tissue compressed by the growth of the granule. Junius[3] found that "there is usually no true fibrous tissue proper to the granulation during the stages of development (up to the time of full growth)."

The term "gelatinous Trachoma" was first used by Stellwag. It includes the more advanced cases of Trachoma, in which the follicles fuse into tumour-like masses or merge into a general infiltration, the tissue assuming a peculiar glassy, gelatinous condition. The individual granulations are then no longer distinguishable with the naked eye. Nevertheless, it has lately become customary to speak clinically of agelatinous stage, when the follicles have a more solid or inspissated appearance, and eversion of the lids or slight pressure causes the expression of a comedo-like plug. It is also usual to call those granulations "early gelatinous" which no longer present either the red colour of young follicles or the frogs' spawn-like appearance of older ones, but possess a peculiar dull grey or greyish yellow tint.[3] The correct estimate of these conditions is obviously dependent upon practical experience; but it is of some importance, because the early gelatinous cases are best treated by mechanical expression.

Anatomically, gelatinous degeneration depends upon a

[1] *Junius*, loc. cit. S. 108.
[2] *Blumberg*, von Graefe's Archiv, Bd. XV. 1, 1869.
[3] *Junius*, loc. cit. S. 99 und 101.

complicated process, including degenerative and regenerative changes in the epithelium, regressive metamorphoses in the follicles—spacing out of the tissue, disintegration and disappearance of the cells, formation of spaces in the follicle, especially in the neighbourhood of Villard's phagocytes—and absorption and cicatrisation in the surrounding adenoid tissue. Transformation of trachomatous products into amyloid has not yet been conclusively proved, though up to 1882 it was considered possible by Stellwag.

E. Berlin [1] and Iwanoff [2] considered the tubular glands —Berlin-Iwanoff glands—which they described in 1878 to be characteristic of Trachoma, though they found them in only two-thirds of the cases they examined. Jacobson,[3] however, proved that these "glands" were in most cases merely epithelial pits abnormally enlarged, and that they were very rarely epithelial tubes or true glands. They are of significance only in so far as they provide crevices in which micro-organisms can lodge, hence tending to further infection.

The tarsus itself is also the seat of important changes, though this has often been doubted. The persistence of the disease is to a large extent due to them. They consist of inflammatory stasis and accumulation of lymph-cells near the lymphatics, or sometimes as small clusters or nests scattered in the tarsus, though never assuming the shape and grouping of follicles nor special differentiation of their cells into phagocytes or Leber's *Körperchenzellen*, etc. Raehlmann lays special stress on the fact that the subtarsal connective tissue is affected; it becomes infiltrated and greatly thickened, subsequently undergoing considerable cicatricial contraction, which is the cause of the trough-like distortion of the tarsus. Fuchs [4] draws attention to the fact that the infiltration and thickening of the

[1] *Berlin*, Klin. Monatsblätter für Augenheilkunde 1878.
[2] *Iwanoff*, Bericht der 11, ophthalm. Gesellschaft zu Heidelberg 1878.
[3] *Jacobson, J., jun.* von Graefe's Archiv, Bd. XXV. 2. 1879.
[4] *Fuchs*, Lehrbuch der Augenheilkunde. Leipzig und Wien 1898, S. 80.

tarsus is greatest near its lower margin along the line of the perforating blood-vessels. There is no doubt, he thinks, that the inflammatory infiltration travels chiefly along these vessels from the conjunctiva to the tarsus; hence that cicatricial contraction following this infiltration is most marked along the sulcus subtarsalis—Arlt's cicatricial band—and it is here that the well-known incurvation of the tarsus is most obvious.

Straub, of Amsterdam, states that he has observed in many cases that Arlt's cicatricial band represents the whole of the shrunken tarsal conjunctiva, which has been dragged towards the edge of the lid. As this occurs, the retrotarsal fold is drawn down until the posterior surface is covered over, mostly by the retrotarsal fold, only a very small area at the margin being covered by the shrunken tarsal conjunctiva. The fold is recognisable by its smooth surface and bluish colour, especially when it has been only slightly affected with Trachoma; moreover, it is very loosely connected with the tarsus, being freely movable over it.

The practical lesson which this theory conveys is that the retrotarsal fold should be preserved, its excision being held by Straub to be absolutely contra-indicated. On the other hand, he recommends treatment by mechanical and chemical means to preserve the healthy parts, and also excision of the tarsus to remove the dangerous *point d'appui* from which the shrinking conjunctiva acts in producing entropion.

It may be briefly mentioned that the bulbar conjunctiva is also frequently affected with Trachoma, chiefly in the neighbourhood of the retrotarsal fold and plica semilunaris. Yellowish transparent granules are found here, sometimes becoming confluent and forming large masses or plaques. Here and there are bodies which are quite analogous to the granulations, containing similar cellular elements and especially large numbers of phagocytes. The conditions are therefore similar here to those in the tarsal conjunctiva; indeed, all the conditions, and especially the relation to the lymphatic vessels, can be much more clearly made out.

The affection of the ocular conjunctiva, therefore, must also be regarded as a specific granular conjunctivitis.[1]

Kuhnt's statement that Trachoma also occurs in the lacrymal sac has been fully confirmed by Germann's[2] researches made upon the abundant material in the Ophthalmic Hospital at St. Petersburg. He found large typical Trachoma bodies, which could be easily expressed, on the lining membrane of extirpated lacrymal sacs. It frequently happens that Trachoma patients suffer at the same time from dacryocystitis; in many cases, however, purulent dacryocystitis precedes Trachoma. Germann thinks it quite possible that trachomatous infection may travel from the nose by way of the lacrymal duct, though the process probably more often spreads in the reverse direction. Th. Wernicke,[3] of Dorpat, also examined a large number of lacrymal sacs, coming to the conclusion that Trachoma does attack this part, and that it is quite possible for the disease to spread from the conjunctiva to the mucous membrane of the sac. Cirincione[4] recently confirmed the same fact; the canaliculi may be closed and the sac blocked by Trachoma bodies.

The old dispute whether follicular conjunctivitis is a mild form of Trachoma or a disease *sui generis* has never yet been definitely settled, and probably never will be until the nature and ætiology of the two diseases are better understood. The anatomical difference between them consists merely in the fact that the inflammatory process in follicular conjunctivitis is not so severe as in Trachoma, while in the former the large cells called phagocytes are usually wanting[5] and the follicle is not transformed into fibrous tissue. Although the clinical symptoms and sequelæ of Trachoma may be sufficiently characteristic in practice,

[1] *Junius*, loc. cit. S. 113.

[2] Comptes-rendus du XII. Congrès international de médecine. Moscou 1898, Vol. VI. S. 125.

[3] *Wernicke*, Zur Aetiologie der Dakryocystitis acuta. Dorpat 1900.

[4] *Cirincione*, Zentralblatt f. prakt. Augenheilk. 1901, S. 456.

[5] *Junius*, loc. cit. S. 120.

it has not proved possible to arrive at a general consensus of opinion as to its nature.

Kuhnt, who first worked in Thuringia, where there is no Trachoma, and subsequently in East Prussia, where it is very common, is of opinion that this question cannot be decided in a region in which the disease is epidemic. He is a strong dualist. "When[1] observations extending over years prove that follicular conjunctivitis always remains the same, but that a change occurs when a person with real Trachoma comes into a house, family, or community, it is surely shutting one's eyes to facts simply to suppose that it is not the Trachoma patient who has communicated the disease, but a sudden increase in the virulence of the germ. Moreover, it seems very improbable that follicular conjunctivitis should arise from infection with the virus of Trachoma, and yet never set up genuine Trachoma itself." Thus the supporters of the so-called "unitarian" theory (Raehlmann, Mandelstamm of Kieff, Lawrentjew, and others), who consider the diseases to be identical, and regard follicular catarrh as an attenuated or abortive form of Trachoma, are found almost exclusively in countries where Trachoma is widespread, whilst practitioners who live in countries almost exempt from it are confirmed "dualists"—*i.e.* they regard the two diseases as altogether different and independent in character. The differential diagnosis will be dealt with more fully again; but we would here express our conviction that on clinical and practical grounds a division must for the present be sharply made into Trachoma (virulent cases) and follicular conjunctivitis (mild cases), on account of the extraordinary difference in course, prognosis, prophylaxis, and treatment. As, however, even the most experienced surgeon is unable in some cases to make a differential diagnosis on the spur of the moment, but is obliged to keep them under observation for a time, we must still admit an intermediate group of cases which are at first doubtful or suspicious: these we isolate as Trachoma, but

[1] *Kuhnt*, loc. cit. S. 9.

treat at first as follicular conjunctivitis. This view has been accepted for several years, as Schmidt-Rimpler stated in 1897 at the twelfth International Medical Congress at Moscow.[1]

The clinical picture and diagnosis of Trachoma have not been simplified by the theory recently put forward by Peters, of Rostock[2]—viz. that there are attenuated or abortive forms of Trachoma in which follicles and scars are never formed. During many years' experience of endemic Trachoma at Bonn, Peters observed two epidemics of acute conjunctivitis, suspiciously like Trachoma, with total absence of any characteristic bacteria. Among the members of the affected families, some only—three out of six—showed true Trachoma bodies after a few weeks, while in the others the conjunctiva remained perfectly free, with only a slight chronic conjunctivitis sicca, in which scarification revealed the presence of a thin layer of adenoid tissue. Peters thinks it must be assumed that all these cases, which ran such a different course, were set up by the same organisms and were essentially the same in character. He did not think it possible that the cases which became trachomatous had been subsequently infected, because after the acute inflammatory symptoms had disappeared none of them ever showed any recrudescence. He is therefore inclined to regard the greater or less development of adenoid tissue as the essential feature of Trachoma. The formation of follicles he would consider merely a reaction from the large amount of adenoid tissue, and perhaps the commencement of the decline of the complaint, which may, but need not necessarily, result in the formation of a cicatrix. In the so-called abortive forms the development of the adenoid tissue can always be made out by the microscope, but it is so slight that it never leads to the formation of follicles, and cicatrices are accordingly absent or are so fine as not to be visible to the naked eye. Peters does not consider every case of chronic conjunctivitis sicca to

[1] Comptes-rendus, etc., S. 127.

[2] *Peters*, Münchener mediz. Wochenschrift 1903, No. 3.

be abortive Trachoma, neither can he bring forward any symptom to clinch the differential diagnosis, but from his clinical experience and microscopical researches he believes that there are transitional forms between true gelatinous Trachoma and chronic conjunctivitis, in which the disease runs an abortive course and very little adenoid tissue becomes developed. He considers, therefore, that it is only the formation, or perhaps the increase, of adenoid tissue, and not the formation of follicles and scars that is the essential feature of Trachoma.

These conclusions are certainly worthy of consideration, and cannot be lightly passed over; particularly the fact, which cannot be disputed, that chronic conjunctivitis is a hypertrophic inflammation microscopically very like Trachoma. The number of these observations, however, is too small to attach any universal value to them. If they should receive general confirmation, the number of doubtful cases of Trachoma would be enormously increased, and the diagnosis would be made still more difficult as long as we are ignorant of the cause of the disease.

As far as our present knowledge will take us, therefore, we can as yet only define Trachoma anatomically as a chronic deep and dense lymphoid infiltration of the conjunctiva (and tarsus), appearing sometimes diffusely, sometimes as circumscribed masses of cells, leading to the destruction of the conjunctiva and its transformation into fibrous tissue, and showing for a time at its onset an abnormal secretion upon which its contagiousness depends.

Finally, we would make a few remarks on the clinical division of the disease and its course. Fuchs[1] calls the hypertrophy of the conjunctiva the most characteristic symptom, and distinguishes two forms of hypertrophy —the papillary and the granular. In the great majority of cases, however, they occur together, the papillary form being most marked over the palpebral conjunctiva, and the granulations over the fornices. The so-called papillæ

[1] *Fuchs*, loc. cit. S. 73.

frequently conceal granules or follicles. Accordingly a third form is distinguished, mixed Trachoma, and even a fourth, the gelatinous Trachoma of Stellwag, is added. These names are certainly of value in defining the nature of any given case and in determining the line of treatment; but generally speaking, as microscopical examination shows, there is essentially only one form, granular Trachoma, for we may in the meantime leave out of consideration the so-called abortive form.

The author thinks that it is of practical importance both for prevention and treatment to separate the dry cases and the discharging ones, as the French writers do.[1] It is only those with discharge that are contagious.

Apart from the rare acute cases, the course of the disease is very insidious and lasts for years and even decades. It may go on for weeks and even months without the patients being aware of its presence. The result is that they do not consult a surgeon until the cornea and vision are affected. There are certainly cases, especially in districts where the disease is endemic, in which it heals spontaneously, without any treatment and without any severe inflammatory symptoms or serious impairment of sight. It is much commoner, however, in untreated cases to meet with the terrible sequelæ already mentioned which finally lead to blindness.

On the other hand, early proper treatment is not an absolute safeguard for a good result. Thus Deneffe, of Brussels, who had the misfortune to become infected during the practice of his profession at the same time as his teacher Libbrecht, relates that although all possible measures were carried out from the very beginning, they did not escape any of the unfortunate sequelæ of the disease. The same result befell Coppez,[2] of Brussels.

The division of the disease into three stages (development,

[1] Hourmouziadès distinguishes in his monograph "De la conjonctivite granuleuse," Paris 1902, "une forme simple ou sèche" from "une forme compliquée (de catarrhe)."

[2] *Kuhnt*, loc. cit. S. 7.

regressive changes, and cicatrisation) is of great practical importance. In the first stage the size, number, and position of the follicles give an approximate idea of its further course. The second stage, which usually appears with severe inflammation and purulent discharge, is extremely infectious. The stage of cicatrisation denotes the end of the process, and is indicative of spontaneous cure. The scar formation destroys the adenoid tissue completely, and therefore, too, the ground upon which alone Trachoma can develop and thrive. No scarring, no cure. The more deeply the conjunctiva, etc., are affected, the more marked is the scarring. This final process has indeed been regarded as a peculiarity of Trachoma. But we no longer consider it to be an inevitable result, as Saemisch once did, because, as we shall see, it is frequently possible by early and appropriate treatment to stop the disease before the appearance of the cicatricial stage.

Further, we may divide the cases into mild, moderate, and severe, according to the severity of the pathological changes, and we may distinguish the worn-out, scarred cases. The severity of any individual case depends very much on the general constitution of the patient; it is particularly severe and obstinate in scrofulous persons.

It is well known that the course of the disease and indeed all its characters present certain differences in different countries: thus, *e.g.*, in Hungary and Russia it is usually more virulent than in the Trachoma districts of Prussia.

Finally, all authors are agreed that the character of Trachoma has on the whole become milder since the time of the great European epidemics, and Raehlmann[1] would explain this on the theory that it has in a certain sense exhausted the ground for its growth by permeating the whole population. Undoubtedly the theory of relative immunity conferred by general infection is not borne out by the history of the disease in Egypt and other countries.

[1] *Vossius*, Lehrbuch der Augenheilkunde. Leipzig und Wien 1898, S. 324.

CHAPTER IV

ÆTIOLOGY

THE contagious nature of Trachoma, then called Ophthalmia, was known to the Greeks more than two thousand years ago, as many records show (Plato, Plutarch, Galen, and others)[1]; indeed, it was believed that the disease might be acquired by merely looking at an affected eye, and this theory of contagion by air is specially put forward by the Arabian physicians Avicenna and Raby Moyses.

During the great epidemics of Trachoma repeatedly referred to which raged over Europe in the early decades of last century, the contagiousness of Trachoma was one of the most vital questions of the day, and was frequently the theme of prize essays. Since it was denied by many, it is easy to understand why the prevention of the disease was at that time often shamefully neglected, so that it was possible for it to become terribly prevalent.

French authors, with Larrey at their head, were fairly unanimous in denying its contagiousness, while the English were all equally agreed upon the point, and showed that it originated in Egypt. In Germany opinion was divided. Rust and Baltz were the champions of the opposing views. The latter denied absolutely that it came from Egypt, and almost as strongly that it was contagious,[2] asserting that during the whole of the German war of independence only one case of ophthalmia from infection—that of an army surgeon—occurred, and that was a case of gonorrhœal

[1] *Hirschberg*, Ueber die körnige Augenentzündung, etc. 1897, S. 29.
[2] *Baltz*, loc. cit. S. 291 f.

ophthalmia. He defended the theory of the spontaneous miasmic origin of the disease under the many unfavourable conditions of life in time of war. Rust, on the other hand, contended that the chief factor in the production of Trachoma was a virus which was continually being reproduced anew by the disease itself, and in this view he was supported by von Walther, Graefe, J. B. Müller, Werneck, Jüngken, Vetch, Mongiardini, Omodei, Adams, and others. C. F. Graefe, whose views were similar to those of Rust, sums up the various views that were then entertained in the following words[1]: "Many held the cause of the disease to be the extremely fine prickles of the cactus plant disseminated through the air, others those of Fillaria papillosa, many fine nitrous or chalky particles entering the eyes, others the atmosphere charged with muriatic fumes, metastasis from some catarrhal, typhoid, dermatitic, or scrofulous complaint, infection with gonorrhœa or syphilis, and others again an infection *sui generis*." Graefe also believed in some specific virus, but at the same time he assumed that there were a number of "indirect causes." These were—too bright light, excess of blood to the head favoured by the unhealthy character of the soldiers' uniforms, especially the heavy helmets, close-fitting collars and tight belts, the heavy knapsacks, fatiguing marches and hardships of all kinds, indulgence in alcohol, dust, close-cropped hair, and previous blennorrhœa. The right eye is said to be more prone to the disease than the left, as Omodei and Larrey have shown.

The people that are particularly subject to Trachoma are the young, weak, delicate people "with pale faces, flabby muscles, and narrow chests," the lower classes, and privates in the army, because they are often deprived of good food, suitable clothes, and proper dwellings, while "officers and the better classes of the community" usually escape—*e.g.* "the freeborn population by the Nile,

[1] *Graefe*, loc. cit. S. 75.

monks, and Mamelukes do not suffer even at the time when the disease is ravaging the poor people by thousands." There was a great liability to the disease among those who were not accustomed to the fatigues of war—the militia, volunteers, young recruits, persons with any hereditary taint or diathesis, and especially such as had not fully recovered from scrofula, syphilis, arthritis, and skin diseases. As occasional causes, C. F. Graefe mentions further "the exhalations of people crowded together," especially in overcrowded, ill-kept infirmaries, foundling hospitals, and workhouses, as well as in all close, damp, and dirty dwellings, muriatic vapours, especially along warm sea-coasts; also diminution of secretion "in the mucous tracts of the lower parts of the body," in the intestine, bladder, and urethra. Numbers of soldiers are said to have suffered from ophthalmia after recovery from diarrhœa and dysentery, and also after suppressed or neglected gonorrhœa. Sudden chills, frequent bivouacs, stations in rainy districts, on the sea-coasts, near lakes, marshes, and large rivers, are mentioned, as well as the autumn season with rainy changeable weather, the too-rapid cicatrisation of purulent wounds, and the too-quick healing of chronic ulcers. Graefe[1] finally observes: "Whether the growth of the disease, which has recently been promoted in this part of the world by the concentration of large bodies of troops and the transmission of miasmata from the Nile, has any connection with the change of climate which manifests itself in the melting of vast icebergs from the North Pole, the almost complete disappearance of the aurora borealis, and the return of the magnetic needle from its deviation to the west, is a question which can only be decided by future generations"!

In Belgium feeling ran high between the two schools, the "contagionists" and the "anticontagionists or compressionists" during the second, third, and fourth decades of last century. The latter would not hear of any other

[1] *Graefe*, loc. cit. S. 72.

cause for the extraordinary epidemic of Trachoma in Belgium than the glare of light reflected from the white tunics of the infantry, and the continuous compression of their necks by their cravats. Yet the epidemic was not in the least diminished by a complete change of uniform.

Decondé[1] in 1841 put forward the following factors as causes of the great Belgian epidemic: (1) its endemic origin, (2) gonorrhœa, (3) infection of adults with the purulent discharge of newborn infants, (4) its introduction from Italy, (5) especially the infection of the Belgian army by English and Prussian troops. At the Ophthalmological Congress at Brussels[2] in 1857 the air was still declared to be the most common medium of transmission for the contagion, and it was then also pointed out that the virus might be conveyed by utensils which had been contaminated in infected places. Overcrowding of rooms is an evil which must be especially blamed for spreading the disease in armies. A. von Graefe maintained even in 1864, and F. von Arlt in 1881, that the disease was transmitted by the air; but this is explained by the conditions of treatment, which was such as to facilitate spread of infection.[3] It was actually asserted at the tenth International Medical Congress at Berlin[4] in 1890, by Sulzer, of Winterthur, who practised for seven years in Java, that air infection was really the rule in the special Trachoma countries, particularly in Arabia and the Sunda Islands. In Java only a very few mild cases of Trachoma occurred during the rainy season, although the people spent the greater part of the night and day huddled together, while the cases became numerous and severe as soon as the dry monsoons[5] began, when great

[1] *Prager*, Med. Jahrb. Bd. III. Heft 3, S. 308.

[2] *Roth* and *Lex*, Handbuch der Militärgesundheitspflege, Bd. III. S. 371.

[3] *Hirschberg*, Ueber die körnige Augenentzündung, etc. S. 30.

[4] Verhandlungen des X. internationalen med. Kongresses, Bd. IV. 10. Abt. S. 35.

[5] Monsoons are periodic winds in the northern part of the Indian Ocean.

quantities of dust were formed and kept in motion by the wind. In almost all the cases it could be proved that these patients had been exposed to the dust for a long time before their infection. It was proved again and again in the Dutch colonial army that the dust was the actual medium of contagion, and it did not merely aggravate a previously existing condition.

It must be added that the vast majority of authors, at any rate in Germany, totally deny infection by air or by dust. Schweigger [1] wrote in 1885: "The causes of Trachoma must be sought chiefly in bad sanitary conditions. Badly ventilated, overcrowded rooms in houses, barracks, schools, factories, etc., may not only produce Trachoma in a previously healthy conjunctiva, but give a trachomatous character to any chronic conjunctivitis."

At the present day, with its great advances in bacteriology, the view which was advocated by von Michel and others, that *Trachoma is an infectious disease spread by contact*, is generally admitted. In addition, however, to this prime cause, which is most probably a specific microorganism as yet undiscovered, the most experienced authors assert that individual predisposition plays a part, while they also admit a number of subsidiary causes—viz. climate, the influence of the atmosphere, soil and race, altitude and latitude, social misery, overcrowding, uncleanliness, and bad hygienic conditions.

We will proceed to deal more fully with the origin and distribution of Trachoma.

It is now generally held that there is a fixed, inevitable contagion which is conveyed by means of the discharge from eye to eye. This transmission may be due directly to spurting of the discharge into the eye during examination or at operations, or indirectly to fingers soiled with the discharge, or the common use of toilet articles—*e.g.* towels, handkerchiefs, washing-basins, also articles of clothing and bed linen—as well as by several people sleeping together in

[1] *Schweigger*, loc. cit. S. 267.

one bed. It is not improbable that the infection may be transmitted by door-latches and stair-rails, which have become contaminated.

De Wecker[1] thinks that the lid margins usually carry and transmit the germs of infection, for it is only in exceptional cases that the disease develops by direct transmission of the discharge to the conjunctival sac. He considers therefore that it is a very important prophylactic measure to disinfect the margins and skin of the lids.

As the discharge conveys the virus, the danger of spreading infection in any individual case is directly proportional to the amount of the discharge; the greater it is, the greater will the danger be to those in the vicinity of the patient.

It is generally believed, but not yet proved, that the disease is transmitted solely by means of the discharge. We have no certain knowledge that the supposed Trachoma germ has any *ectogenous existence*; yet from the experience derived in trachomatous countries this cannot be summarily dismissed. We have already seen that Sulzer believes in air and dust transmission. Germann's[2] clinical observations led him to suggest that the germ lay in the soil, while Hirschberg[3] incidentally states that it may grow in standing water. Schmidt-Rimpler,[4] again, considers that in Egypt, for example, it is impossible to exclude air transmission. Kuhnt[5] advances the theory that in certain districts the soil or water harbours the germs. This is supported by the fact that in trachomatous areas the fresh cases with discharge appear in greatest numbers during the warmer months, when the soil water sinks, the pools dry up, and the agricultural people spend most of the day in the fields. The muco-purulent nasal catarrh, which very frequently occurs at the same time, suggests that the germs are carried in the dust by the air, settling on the nasal mucous

[1] *de Wecker*, Die ophthalmologische Klinik. III. Jahrg. 1899, No. 4.
[2] *Germann*, St. Petersburger med. Wochenschrift 1890, No. 29.
[3] *Hirschberg*, Ueber die körnige Augenentzündung, etc., S. 14.
[4] *Schmidt-Rimpler*, loc. cit. S. 8.
[5] *Kuhnt*, loc. cit. S. 20.

membrane as well as on the conjunctiva. In this manner the supply of fresh germs would be continuous in Trachoma districts, the peculiar severity and persistence of the disease in those parts would be explained, as well as the favourable effect of removing to non-infected spots. Finally, A. Peters [1] believes that the Trachoma germ has "a more universal distribution," and, like Kuhnt and others, attaches great significance to individual predisposition. This is due, he thinks, to the bad mode of life and to certain conditions of place and soil not yet adequately explained, and especially to inherited and constitutional traits which favour the development of adenoid tissue. Where this predisposition is slight, only abortive cases, as they are called, arise; but if it is strong, distinct Trachoma granulations develop.

There is no doubt that a *low state of civilisation, want of cleanliness, and overcrowding* play an important part in spreading the infection. Thus in Prussia, Trachoma is most common in the three provinces (Posen, East and West Prussia) in which plica Polonica, or elf-lock, is still met with—a result entirely of uncleanliness and neglect of the scantiest attention to the hair. In any individual case Trachoma can easily be avoided by regard for cleanliness and the simplest hygienic precautions. This fact is also emphasised by Lucanus, to whom we are indebted for valuable researches on the contagiousness of Trachoma. He stated [2] in 1890 that in the Marburg Ophthalmic Hospital patients with severe acute and chronic Trachoma, or with freshly inflamed cicatrised Trachoma with free purulent discharge, lay side by side with others not suffering from the disease without the slightest suspicion of infection appearing.

The chief seat of infection is the family, especially among the poor with their small dwellings. Lucanus found 135 cases in which Trachoma occurred several times in the same families, and he could specify a number of families in

[1] *Peters*, Münch. med. Wochenschrift 1903, No. 3.
[2] *Lucanus*, loc. cit. S. 29.

which six, seven, and more cases of the disease had occurred during the year, as well as a large number with three or four members suffering from it. In the great majority of cases the infection was conveyed by the use of the same towel, and frequently by several of the family sleeping in one bed. Not infrequently a family was infected by a trachomatous servant. Lucanus is therefore inclined to look upon every one in Hesse as liable to the disease if one member of the family has it, and every labourer or servant-girl that works or sleeps with persons already infected; for these people almost invariably catch the complaint sooner or later. Lucanus does not believe in any particular individual predisposition. He found, too, infection in many cases among married people.

Vennemann, of Louvain, kept a record for several years of 100 cases in Belgium, 50 of them being married, paying special attention to the danger of infection to the families. These patients were in close daily contact with 497 persons, of whom only 40 became infected. Of the 100 families there were only 28 in which the disease spread; 72 remained free, and of these 40 were married. In none of the 28 families were all of the members infected—in 19 only one, in 5 two, and only in 3 a greater number. It was remarkably rare to find that married couples infected each other; this occurred only 7 times in 50 families. Vennemann holds, therefore, that there is an individual predisposition to Trachoma, and supports the well-known view that the Trachoma of to-day springs from the old military ophthalmia, which in the course of years has to a large extent lost its virulence and contagiousness.

After the family, the next great seat of infection is all those places in which large numbers of people are crowded together in a comparatively small space, who often come into personal contact with one another, or make use of common washing-utensils or other articles. Such places would include crèches, boarding-schools, seminaries, penitentiaries, workhouses, orphan asylums, inns, and the like.

There is no doubt that here also want of cleanliness plays a very important part, and a single person affected with the disease is quite sufficient to spread it and cause it to become endemic over the whole of that institution.

It has not yet been proved that the contagion can adhere to the walls of a room which has been occupied by a Trachoma patient. According to Vossius,[1] however, this is the only explanation which can be given in cases where every new arrival contracts the disease, while no fresh attacks are seen when the rooms have been carefully cleaned out, and they have been repainted. Förster[2] also believes that the disease is spread by infected quarters, and indeed considers this a more serious and frequent source of infection than that from person to person.

Schools play a comparatively small part in the spread of Trachoma, but a greater part in that of follicular conjunctivitis. In Germany, except in the eastern provinces, where the disease is endemic, it is rarely seen in schools, and is still more rarely distributed through their agency. Trachoma is therefore not a true school disease, and never becomes such except under the worst hygienic conditions. It is more often found endemic in private institutions and boarding-schools, the inmates of which live more like families and make common use of sitting-rooms, bedrooms, and washing-utensils. H. Cohn proves this in his *Lehrbuch der Hygiene des Auges*[3] by the results which he gives of the examination of numerous schools. Naturally this is different in Trachoma countries; but in them, too, the family continues to be the chief source of infection.

It is notorious that for at least a century *the army* has played an extremely important and dangerous part in the spread of Trachoma. It was formerly an excellent culture medium for the virus. It usually happened that through want of precaution a person or persons suffering from the

[1] *Vossius*, loc. cit. S. 325.
[2] Das Sanitätswesen des preussischen Staates 1889-91.
[3] *Cohn, H.*, loc. cit. S. 121.

disease were drafted into a regiment. The complaint was chronic, and showed no sign of discharge ; hence it remained unnoticed and harmless for a longer or shorter time. But whenever the eye caught cold or was exposed to smoke, dust, or the ammoniacal vapours of the stables, discharge began to appear and became a source of contagion. In the close, overcrowded, badly ventilated, and ill-constructed rooms of barracks and soldiers' quarters, in which at the beginning of last century the men frequently slept two in a bed [1] and used common washing-basins and towels, the disease was bound to spread with alarming rapidity, and to assume in a very short time the character of a plague. It was only then that it began to attract the attention of the higher authorities, and that a definite system of treatment was instituted. This, however, was, generally speaking, unable to effect much in time of war, in overcrowded hospitals, when hygiene, prophylaxis, and treatment were at a very low ebb. The vast majority of trachomatous soldiers were ultimately sent back to their homes either uncured or only apparently cured. In most countries no satisfactory preventive measures were taken by the civil authorities, so that every trachomatous soldier might eventually become a wandering source of infection in his native district. In Belgium, in 1834, there was a strong conviction that Trachoma flourishes and spreads exclusively in the army, and cannot touch the civil population! [2] The people who became gradually more and more affected through these soldiers every year furnished the standing army with reinforcements of trachomatous recruits, a seed which yielded a terrible harvest in the fertile soil of the barracks.

It is easy for us to understand how suitable the term "military ophthalmia" was. Lawrentjew,[3] oculist to the

[1] Cf. *Neumann, O.*, Die Prophylaxe im Militärsanitätswesen. München 1900, S. 31.

[2] *Deneffe*, Bulletin de l'Académie royale de médecine de Belgique 1893, S. 97.

[3] Comptes-rendus du XII. Congrès international, etc., Vol. VI. S. 121.

Moscow military district of fourteen departments, could justly assert, at the International Congress at Moscow in 1897, that the disease was conveyed from the army into areas which were previously free. "There are still some departments in the district," he remarked, "which are quite free from the disease; some time ago, however, this applied to the whole of Central Russia. Since the larger number of the recruits in the Moscow military district have been drafted to the western frontier, to Poland, they have returned with Trachoma, and have infected areas which were previously unaffected, while the troops in the Moscow district draw their recruits from the eastern Russian provinces, and they in their turn introduce most of the Trachoma into our regiments. Thus, by the infection of unaffected areas by the troops on the one hand, and the introduction of Trachoma by the recruits into the army on the other, a vicious circle is formed, for which it is very difficult to find a cure."

Sattler,[1] of Prague, in his paper on the geographical distribution of Trachoma before the Berlin Congress in 1890, also made special reference to the fact that this was primarily determined by certain peculiarities in the movements of the troops and in garrison life. In proof he quotes the case of troops recruited from mountainous parts of Austria, which were frequently sent into the trachomatous garrisons of northern Italy or the infected provinces on the southern Danube; while, on the other hand, Hungarian, Polish, and Italian regiments were drafted into hilly provinces of Austria. The district in Upper Franconia around Kulmbach and Bayreuth, where Trachoma is endemic, was also exclusively infected by the Austrian troops which were quartered there every year from 1822 to 1859 on their march to and from the infected federal fortress of Mainz. In a similar manner the disease was introduced into Hohenzollern, which for a considerable time formed an island of infection in the

[1] Comptes-rendus, etc. S. 29.

unaffected kingdom of Würtemberg.[1] It was brought about by time-expired soldiers who were enrolled into Prussian regiments on the Rhine and in eastern Prussia.

In the medical reports of the Prussian army for the years 1873 to 1878, it is stated that non-commissioned officers who sleep in the same rooms as trachomatous soldiers are only very exceptionally infected, because they do not use the same washing-utensils as the privates. This perfectly correct observation militates against the idea that infection is conveyed by the atmosphere of a room.

In Chapter II. we made ample reference to the well-known fact that within the last decade Trachoma has travelled from the infected eastern provinces of Germany and the adjoining frontier by a distinct westward track, following the lines of trade, and that it is conveyed almost exclusively by migrating workmen, agricultural labourers, canal men, and miners, whereas its spread by means of the regular railway traffic may be practically excluded.

Moreover, as has been already mentioned, the severity and contagiousness of Trachoma have diminished considerably. This is chiefly connected with the progress of civilisation and public hygiene, and less with immunity conferred by infection of the whole population, as supposed by Raehlmann. Nevertheless, it would be utterly wrong to deny its contagiousness entirely, as Förster and others[2] have recently sought to do. We must never forget the result of that gigantic but ill-fated experiment in Belgium in 1834, when the discharged trachomatous soldiers infected the civil population throughout the whole country, which till then had been almost free from the disease, thus bringing about a national calamity which was unique in the annals of the people. There are plenty of examples, too, of occulists—Deneffe, Libbrecht, Rivers,[3] and others—

[1] No longer so. Cf. Sanitätswesen des preussischen Staates 1898 bis 1900, S. 149.

[2] *Cohn, H.*, loc. cit. S. 133.

[3] *Eloui*, loc. cit. S. 11.

who became infected with Trachoma in the course of their professional duties. Only a minimum of such cases have been published.

Still, the experience of the last decade has taught us that the transmission and spread of Trachoma proceed now relatively slowly—at any rate, more slowly than in the case of acute epidemic catarrhs; hence it must be inferred that the virus of Trachoma is less potent and transmissible. *Inoculation experiments* were tried at an early stage. Piringer[1] inoculated the left eye of a blind beggar with mucus from a case of chronic so-called Egyptian ophthalmia: three minutes later he carefully washed out the eye and applied cold compresses for ten hours; but the result was negative. It may be inferred from this that the virus is slow in its action.[2]

As for the other numerous inoculation experiments carried out in the early decades of last century, the results are of little value, because no distinction was made between Trachoma and blennorrhœa. The experiments of Mackesy, Vansevendonck, Kriebel, and Adams—in some cases made upon themselves—all gave a negative result. In 1823, during the epidemic at Klagenfurt, Werneck inoculated two attendants, who had remained immune for a long time, though they were nursing the worst cases of eye disease. He excised the granulations of a patient who had had them for two and a half years, and rubbed them gently over the attendants' conjunctivæ several times. Both exhibited the most pronounced and typical attacks of the disease[3] after nine to fourteen days. Otherwise the author has been unable to find any data as to the length of the incubation period. So far as experience goes, it is frequently a long time after accidental infection before the patient observes slight signs of inflammation. Seeing that the disease has such an insidious and almost

[1] *Piringer*, Die Blennorrhoe am Menschenauge. Graz 1841.
[2] *Schmidt-Rimpler*, loc. cit. S. 3.
[3] *Eble*, loc. cit. S. 164 ff. und S. 63.

imperceptible onset, it is generally difficult in practice to determine the date of infection in any considerable number of cases. Experience, however, teaches that infection does not readily occur, but usually only after prolonged contact with patients and the common use of beds and washing-utensils. Then one person after another is slowly infected.[1]

Speaking generally, then, we can only claim a restricted and conditional contagiousness for Trachoma, not underestimating the significance of individual predisposition. The second stage of the disease, as we have seen, is the most infectious.

The results of the older *experiments on animals* are so contradictory [2] that no reliable conclusions can be drawn from them as to pathogenicity. In most cases pus from blennorrhœa was employed for inoculation. As to recent experiments on animals, the author is only acquainted with successful results in rabbits.[3] It is said, however, that eye diseases are common in horses, oxen, sheep, and dogs on the Lower Nile.

The nature of the infectious agent is a problem which unfortunately has never yet been solved. As Uhthoff [4] observed at the twelfth International Congress, at Moscow, in 1897, in his exhaustive paper *On the Present Condition of Bacteriology in Inflammations of the Conjunctiva and Cornea*, the specific bacteria of Trachoma are still unknown, and none of the organisms which have as yet been described can be accepted with certainty. The search was commenced over twenty years ago, and has been prosecuted with infinite zeal and energy by numerous investigators to the present day. It would necessitate a bulky monograph to go into these interesting researches in detail. It will suffice to refer to the exhaustive work

[1] *Greeff*, loc. cit. S. 96.
[2] *Eble*, loc. cit. S. 164 ff und S. 63.
[3] *Alt*, Americ. Journ. of Ophthalm. 1886, S. 161.
[4] Comptes-rendus, etc. S. 4.

by Cazalis,[1] which appeared in 1895, and to give here merely a rough sketch of the results hitherto obtained.

Micrococci were found most frequently, usually in the form of diplococci which had more or less resemblance morphologically to Neisser's gonococcus, but were not decolourised by Gram's method—Sattler in 1881, von Michel in 1885, Raehlmann in 1885, Poncet in 1886, Désormes in 1886, Kucharski in 1887, Wagjeewski in 1887, Petresco in 1888, Schmidt, Staderini in 1888, Wilbrand-Saenger-Staehlin, Fulton, and others. The descriptions given of these micrococci by their various discoverers are often so divergent that it would be necessary to assume that there were at least several kinds of diplococci.

The greatest expectations were for a considerable time aroused by the diplococcus which Sattler[2] first found in the conjunctival discharge and, it was stated, in the follicles of Trachoma, and which he had separated in pure culture. He inoculated a healthy human conjunctiva with the pure culture, and was able, according to his account, to produce Trachoma. After inoculation experiments in animals had been successful, he introduced micrococci from the third generation of a culture into the conjunctival sac of a man, and rubbed them in. "In five days the first vesicular granules of Trachoma appeared, and ran a very mild course." This alone could scarcely justify the conclusion that typical Trachoma had been produced. Sattler conjectured that his diplococcus possibly originated in Neisser's through variation in culture, a view which was calculated to explain the similarity in the clinical picture of chronic blennorrhœa, or so-called postblennorrhœic conjunctivitis and chronic Trachoma.

Sattler's discovery seemed to be confirmed at first by Robert Koch's results in 1883 and von Michel's in 1885. During his journey through Egypt and India with the

[1] *Cazalis*, Étude bactériologique sur la conjonctivite granuleuse, 1895.

[2] Bericht über die 14. Versammlung der ophthalm. Gesellschaft zu Heidelberg 1882. Zentralblatt f. prakt. Augenheilk. 1882, S. 458.

Cholera Commission in 1883, Koch[1] examined the conjunctival discharge of fifty cases of Trachoma, and found in them two different kinds of bacteria, which produced two different diseases. One, which ran a virulent course, was caused by a micro-organism similar to the gonococcus—gonorrhœal conjunctivitis; in the other, a milder disease, large numbers of small bacilli similar to those of mouse septicæmia were regularly found in the pus corpuscles. The latter are now known as the Koch-Weeks bacilli.

In 1885, during an epidemic of so-called Egyptian ophthalmia in a boys' orphanage at Aschaffenburg, von Michel[2] found diplococci in the discharge and follicles in 69 cases; they differed from Sattler's only in minor points, and were distinguished by their minute size and the narrowness of the line separating the cocci in each pair. They did not show spontaneous movement. Von Michel too thought that he could produce Trachoma by inoculation. Since all his cases ran a perfectly benign course—they all became well under the use of a weak sublimate solution (1 in 5,000) and gentle massage with ½ per cent. yellow oxide of mercury ointment, without the slightest corneal complication—it must be assumed that this was an epidemic of follicular conjunctivitis. This explanation is also given by Logetschnikoff,[3] and as a matter of fact von Michel's diplococcus apparently has some significance as the exciting agent in many forms of follicular catarrh.[4] The cocci discovered by the other authors mentioned have also hitherto failed to prove of importance in the ætiology of Trachoma; they were mostly either gonococci or pneumococci.

Bacilli were found by other observers—first by Hirschberg and Krause[5] in 1881—in the discharge of people

[1] *Junius*, Zeitschrift für Augenheilkunde Bd. I. 1899, S. 504.
[2] *von Michel*, Archiv f. Augenheilk. 1886, S. 380.
[3] *Logetschnikoff*, Nagel's Jahresbericht für 1887, S. 206.
[4] *Silex*, Kompendium der Augenheilkunde. Berlin 1902, S. 85.
[5] *Hirschberg* and *Krause*, Zentralblatt f. prakt. Augenheilk. 1881, Septbr.

suffering from acute Trachoma, while they were absent in chronic Trachoma. The bacilli found by Koch in 1883, and now called the Koch-Weeks bacilli, have already been mentioned. They are known to give rise to an acute contagious conjunctivitis which often breaks out in epidemic form.

The same bacillus was discovered in Egypt in 1881 by Kartulis. In 1891 Shongolowicz [1] found in 38 trachomatous patients a bacillus 1 to 2 μ long and 0·3 to 0·5 μ broad, which stained with Gram's method and produced the disease in animals on inoculation with pure cultures.

The bacillus found by L. Müller [2] in 1897 in 23 out of 63 cases of Trachoma is morphologically scarcely distinguishable from the influenza bacillus, and in culture not at all. It has not been proved to be the cause of Trachoma, and is probably identical with the Koch-Weeks bacillus.

It is probable that some pathogenic significance should be attached to the diplococci in certain forms of epidemic follicular catarrh, in which they have been found by Sattler, von Michel, and others, though not in Trachoma. Of all the numerous inoculation experiments which have been made on animals and sometimes on men, not one has resulted in typical Trachoma.

Equally unimportant from an ætiological point of view are the rarer micro-organisms which have been found, such as the microsporon trachomatosum of Noiszewski [3] (1890), which is said to be allied to the microsporon furfur of Kaposi and the streptothrix Försteri (Cazalis).

Cazalis, who found a large number of non-pathogenic organisms in his experiments in 1896, as da Gama Pinto had done in 1884, and Reid in 1889, finally came to the same conclusion as Truc, that the bacteria of various forms of conjunctivitis can under certain conditions and with the aid of certain predisposition on the part of the patient

[1] *Shongolowicz*, St. Petersburger med. Wochenschrift 1890, No. 28-30.
[2] Wiener klin. Wochenschrift 1897, S. 920.
[3] *Noiszewski*, Zentralbl. f. prakt. Augenheilk. März 1890.

produce Trachoma. He looks upon the formation of follicles as a special defence against the injurious agents which have found their way into the conjunctival sac.

Other observers like Mutermilch,[1] Cuénod, and Gunning, after many negative results, absolutely deny the parasitic origin and infectiousness of Trachoma. From the analogy of the bacteria found in some severe cases of diphtheria, others[2] again assumed a mixed infection with various specific organisms, which were so dependent upon one another for the necessary conditions of life that they could only become active and cause Trachoma when combined.

Following up the researches on the pathogenicity of the protozoa, Burchardt, Czaplewski, and Elze have looked for the cause of Trachoma amongst them. In 1897 Burchardt[3] found in the epithelium—magnified 500 diameters—numbers of well-defined, oval, non-nucleated, apparently solid bodies, which he called coccidia. The results of inoculation experiments were negative, and he subsequently found the bodies in other conjunctival diseases.

In the same year Czaplewski[4] isolated from the contents of Trachoma follicles peculiar large cellular amœboid bodies, of very variable shape. They were 10 to 30 μ in size. In that year, too, Elze[5] found both in the discharge and the follicles of a case of Trachoma of five weeks' standing, bodies like plasmodia, which in hanging drops of salt solution showed movement; he classed them amongst the monads. Finally, Dr. Katharina Kastalsky,[6] of Moscow, examined forty cases of Trachoma, and invariably found in the subepithelial and deeper layers of the conjunctiva—rarely in the epithelium—round hyaline bodies, 10 to 15 μ in diameter, homogeneous in appearance,

[1] *Mutermilch*, Annales d'Oculistique, Bd. CIX. 1893.

[2] *Lawson*, The Royal London Ophth. Hospital Reports, December 1897.

[3] *Burchardt*, Zentralblatt f. prakt. Augenheilk. Februar u. April 1897.

[4] *Czaplewski*, Sitzungsbericht des Vereins f. wissenschaftl. Heilkunde in Königsberg vom 8 März 1897.

[5] *Elze*, Ueber Plasmodienbefunde bei Trachom. Zwickau 1897.

[6] Comptes-rendus du XII. Congrès, etc. S. 113.

and unaltered by ether, alcohol, chloroform, acetic acid, sulphuric acid, hydrochloric acid, nitric acid, or alkalies. These bodies may be due to the same causes that obtain in other chronic inflammations—*e.g.* in elephantiasis, polypi of the nose, ear, and stomach, at the edges of ulcers of the leg, etc.; or they may be considered a reason for classing Trachoma among the granulomata, since round hyaline bodies are found in granulation tissue tumours, such as rhinoscleroma, tubercle, syphilis, and actinomycosis.

All efforts to discover the germ of Trachoma have as yet proved fruitless. It is not improbable that the germ, like that of rinderpest, is so small that it passes through bacteriological filters, whilst our present optical apparatus and methods of staining are not sufficiently delicate to enable us to detect it.[1]

Although we are still quite ignorant of the virus, yet we know with certainty that it is contained in the discharge, in which it is carried from eye to eye. It appears to have extremely low vitality and little resistance,[2] so that it is only conveyed directly—*e.g.* by contact—and never by means of intermediate persons or things. The temperature of the atmosphere seems to have little effect upon it, whilst the humidity has an important influence. The discharge remains virulent for a considerable time in moist surroundings, such as on wet linen or in damp air; but it very quickly ceases to be contagious on a dry material, and drying the discharge renders it at once inactive. The comparative dependence of the virus upon the moisture of the air readily explains the existence of trachomatous areas in low-lying parts by coasts, rivers, and marshes. Whether the epithelium of the conjunctiva must be broken before infection can occur, as Chibret and others hold, must remain an open question until the germ is discovered.

Clinical experience compels us to admit a greater or

[1] *Römer*, Die Bedeutung der Bakteriologie in der Pathologie des Auges. Würzburg 1901, S. 36.

[2] *Raehlmann*, Ueber die Nosologie des Trachoms, etc. S. 633.

less *individual predisposition* and a certain *immunity*, for it often happens that members of families, married people, children, and so on, remain free for many years, although they live permanently with infected people on great terms of intimacy. There is a tendency to trace the immunity to the chemical composition or bactericidal properties of the lacrymal secretion.[1] It is perhaps connected with the alkalinity of the fluid,[2] so that some self-protection is provided. This is greatest in the smooth, healthy conjunctiva, and is diminished or abolished in a loose, rough, folded, or discharging conjunctiva, which supplies nooks for the organism to hide in.

Most observers believe that the individual predisposition is dependent upon general constitutional conditions, bad nutrition, anæmia, and scrofula. This connection becomes very evident on Blumberg's theory.[3] He starts from the direct communication which the lymphatic system possesses with the meshes of the reticular connective tissue, and holds that the most important factor in producing Trachoma is to be found in the laxity of the reticular tissue brought about by some constitutional taint. This atony causes an excess of pressure in the lymph-capillaries, resulting in profuse migration of leucocytes into the meshes of the adenoid tissue. According to modern ideas, it is natural to suppose such a diminished resistance and want of tone in the tissues in conditions of general malnutrition and constitutional weakness, as in badly nourished, weakly individuals and those suffering from scrofula and tubercle. Writers of great repute like von Arlt, von Michel, Raehlmann, and others, set scrofula more than any other condition in close ætiological relationship with Trachoma. Schmidt-Rimpler[4] emphasises the fact that the general state of the health is often a great obstacle in treatment, and that

[1] *Kuhnt*, loc. cit. S. 19.
[2] *Matkovic*, Recueil d'ophthalmologie, Februar 1898.
[3] *Blumberg*, loc. cit. Von Graefe's Archiv. Bd. XV. 1, 1869.
[4] *Schmidt-Rimpler*, Augenheilkunde und Ophthalmoskopie 1901, S. 434.

particularly severe and obstinate cases are met with in scrofulous persons. Cazalis and Truc also consider that Trachoma requires a *terrain prédisposé*; and Hourmouziadès remarks, in his monograph already referred to: "In practice, as a general rule, cases of Trachoma in lymphatico-scrofulous subjects are severe; on the other hand, the disease is relatively benign in persons exempt from this predisposition." Baeck,[1] of Gleiwitz, observed in his practice what probably most have seen, that Trachoma and scrofulous complaints of the eye very often occur together, and in all his trachomatous patients he was able to find some scrofulous taint—of course only in relatively young people, while in elderly people the taint becomes obscured. Hence Baeck is convinced that the scrofulous diseases of the eye are not caused by a single type of bacterium, and this is borne out by Axenfeld's researches; further, Trachoma may arise in a scrofulous person from all the possible bacteria of conjunctivitis.

Although this hypothesis is not by any means fully established, we find so many authors supporting the view that Trachoma and scrofula are connected, that it cannot be summarily dismissed. Hummelsheim,[2] of Bonn, saw in a short period three patients between eight and eighteen years of age with phlyctenular conjunctivitis, in whom typical Trachoma developed after it had subsided, though no source of infection could be discovered in any of them. He believes, therefore, like Vennemann, Truc, and others, that conjunctivitis phlyctænulosa or scrofulosa renders the eye more susceptible to the action of the Trachoma germ. Baeck goes so far in insisting on this predisposition as to say: "People who are not predisposed do not take Trachoma, even if they are infected; while the predisposed take it, in spite of all attempts to avoid infection." The latter statement is exaggerated, for everyday experience teaches us how comparatively easy it is to guard against

[1] *Baeck*, Münch. med. Wochenschrift 1900, S. 256.
[2] Zentralblatt für prakt. Augenheilkunde 1902, S. 310.

infection. Baeck also remarks that he has repeatedly inoculated himself, but never obtained a positive result; but he does not give an exact description of his method of inoculation. Blumberg also remarks, with reference to his theory, that the diminished resistance may be found in the reticular connective tissue of the conjunctiva alone, without there being necessarily a general want of tone in the tissues. Recurrent attacks of conjunctivitis frequently cause this condition, and so a continual state of irritation is kept up.

We come now to another kind of predisposition which may be acquired by people otherwise in good health. It may be described briefly thus: All chronic irritative conditions of the eye, and especially obstinate conjunctivitis, augment the tendency to Trachoma. If we consider the predisposition to consist in an overgrowth of adenoid tissue, as Peters does, Blumberg's theory becomes very plausible, and we can readily understand how repeated chronic inflammatory conditions of the eye produce sponginess, atony and tendency to proliferation in the adenoid tissue. In the light of this theory, however, we are undoubtedly forced to admit that individual predisposition is increased by external sources of irritation. Among these dust and smoke are of prime importance, for by long-continued action they set up chronic conjunctival irritation. Further, heat, moisture, wind, want of sleep, overcrowding, and bad ventilation must be mentioned. We shall return again to these injurious agents, but we may briefly refer here to their great importance in military life, especially in former times, when military hygiene was at a lower level.

These irritants can not only produce a certain predisposition, or aggravate it if already present, but they will also indirectly increase the infectiousness of persons already suffering from the disease. The result of irritants like heat, smoke, dust, dazzling light, wind, sweat, etc., acting upon a Trachoma patient is to cause itching of the eyes. The patient then rubs them instinctively and

involuntarily, thereby soiling his fingers with the discharge, which he transfers on contact with those about him.

It is clear that this individual predisposition, which consists essentially in a tendency to overgrowth of adenoid tissue in the conjunctiva, may also be inherited, since certain constitutional weaknesses are often inherited by children from unhealthy parents, so that a family predisposition may be set up. Naturally the intimate intercourse between the various members of a family also exposes them all to the same external irritants.

It is of course not always easy to decide in any given case whether it is a question of greater predisposition. There are no signs sufficiently characteristic to enable us to determine where the effect of infection stops and that of predisposition begins. It is enough to bear in mind that *the family is the main channel for the spread of Trachoma*, and to a certain extent the incubator of the virus.

Further, *the influence of vocation* must not be underestimated. It is an old observation, recognised by almost all investigators, that those whose calling compels them to work in a foul and dusty atmosphere are particularly liable to become infected with Trachoma. Thus the disease is frequent among farm and day labourers, miners, masons, etc. From what has been said, we must assume that the dust intensifies the predisposition by setting up an inflammatory condition, leading to rubbing of the eyes and face. In this manner small abrasions of the epithelium may be produced—especially with sharp sand dust—risk of infection being thereby increased. On the other hand, the unfavourable social and economic conditions of these people, and particularly their lack of cleanliness, are of the greatest importance, much augmenting the danger of infection.

The *overcrowding* of people in small rooms under unfavourable social and hygienic conditions is of very considerable importance as a contributory cause. We have

already referred again and again to this point, so that it is superfluous to follow the matter further. We have seen that *want of cleanliness* plays a very important part here, and we shall not find it difficult to understand that Trachoma most, and almost exclusively, affects the lower classes—that it is distinctly a disease of the proletariat. Bad hygienic and social conditions, poverty, insufficient food, and still more want of cleanly habits, wretched houses, indolence, and ignorance, promote the spread of Trachoma to an enormous extent, and these contributory causes must be reckoned among the most important and most terrible because they are the most difficult to remove. The better classes of society, on the other hand, are less exposed to infection, because they live in more capacious dwellings, come less into actual contact with other members of the family, and have cleanlier and more hygienic modes of life.

The injurious effect of prolonged overcrowding in small insanitary rooms is illustrated by the well-authenticated epidemics in pauper schools, orphan asylums, etc., and on board vessels, not to speak of the many equally authenticated epidemics among the troops. The serious outbreak of Trachoma in a factory at Brauweiler, on the Lower Rhine, is well known. It occurred in 1813-5 and again in 1818-21, attacked all the inmates, and was stamped out by Philipp von Walther[1] by excision combined with enforcement of hygienic regulations. In a pauper school at Holborn all the children, numbering 500, had Trachoma.[2] In 1840 Hairion found 64 girls in an orphan asylum at Mechlin, out of a total of 66, affected with the disease; and in Mons 71 out of 74. The notorious epidemic which broke out in 1819 on the French slaveship *Rodeur* and attacked all on board, including 160 slaves, seems to have been acute blennorrhœa, and not Trachoma. In that vessel 39 negroes, 11 sailors, and the ship's surgeon lost the sight

[1] *Ph. v. Walther*, Journal d. Chirurgie und Augenheilkunde 1821, 2. Bd. S. 127 ff.
[2] *Fuchs*, loc. cit. S. 89.

of both eyes, while 12 negroes, the captain, and 4 sailors lost one eye, and 14 negroes and 4 sailors suffered from permanent corneal opacities.

As regards *age*, Trachoma is commonest in Germany between ten and forty. No age, however, is exempt, and in Trachoma countries proper children are infected by their mothers and nurses in earliest infancy. Straub, of Amsterdam, is of opinion that Trachoma can readily be conveyed to infants, but only with difficulty to adults, and in this he is supported by the report of the Dutch colony of Java. He also considered it to some extent a disease of children, but this opinion has been rightly contested for Germany.[1] In any case, all experience shows that age in itself neither confers immunity nor favours predisposition, the disease being dependent on the chance of infection.

Neither does *sex* predispose specially to Trachoma. The fact that females are more prone in many countries—*e.g.* the Russian Baltic provinces—is explained by their being more tied to the house, and thus more exposed to the injurious smoke, the houses being formerly built without chimneys. Women, too, are largely employed at dusty work in the fields. It is possible that they came more willingly to the appointed medical examinations than the men.[2] It is unnecessary to enlarge upon the fact that they come into more intimate contact with the members of the family, thus spreading the disease more than the others. There is no doubt that in Trachoma countries they are *par excellence* the carriers of infection.

We come now to the influence which *telluric and climatic conditions* have on the spread of Trachoma. This influence cannot be denied, as we have already seen when discussing the geographical distribution, although the ectogenous existence and propagation of the virus have never yet been proved. We saw that there was no disease

[1] *Hoppe*, Ist das Trachom eine Krankheit der frühesten Jugend? Stuttgart 1901, S. 9.

[2] *Weiss*, loc. cit.

which was so widespread over the whole world. In many countries it occurs only in sporadic cases, while in others it is endemic and pandemic, an ineradicable pest.

A glance at the map shows in the first place that Trachoma is prevalent in low-lying land along rivers, by the sea-coasts, and in marshy plains. Running water seems to check its spread, while deltas, stagnant pools, and marshes are favourable. Among the deltas in Europe the most affected are those of the Rhine, Danube, Rhone, and Tagus; in Asia, the Euphrates and Tigris; in Africa, the Nile; in America, the Mississippi and Amazon. For the present it must remain an open question how far telluric and atmospheric conditions influence the spread of the disease, and whether more importance should not be attached to commerce, the lines of which follow for the most part the great rivers.

Raehlmann is convinced that the virus is to some extent independent of the temperature of the air, but is very considerably influenced by its humidity, inasmuch as the discharge retains its virulence for a long time in a moist atmosphere and amid damp surroundings, thus explaining the frequency of the disease in low-lying districts near coasts, rivers, and marshes.

Other investigators have pointed out that Trachoma bears a certain relationship to malaria, since it is quite possibly also caused by a plasmodium, and is frequently found in malarial districts. In treatment, too, Elze[1] thinks that he has noticed some connection between the two diseases, quinine, according to him, being very beneficial in Trachoma. This is by no means established, and there is as yet absolutely no proof that malaria has any ætiological connection with Trachoma.

Ziehm[2] has actually distinguished two separate kinds of Trachoma, one due to dust, the other to marshes. He maintains that in Trachoma, as found in families and in its

[1] *Elze*, Ueber Plasmodienbefunde bei Trachom. Zwickau 1897.
[2] *Ziehm*, Wiener klin. Wochenschr. 1900, No. 41 and 42.

endemic form, infection from person to person can be absolutely excluded. He has brought forward no proof of this assertion, which experience utterly refutes.

Of course the influence of dust in spreading the disease cannot be disputed. Still, it is of importance only as a contributory cause, which acquires a very considerable significance in warm countries. The irritant action of the dust tends to increase the amount of discharge, and with it the power of infection. Thus it is frequently endemic in warm countries. Egypt, Algeria, Tunis, Arabia, Syria, Palestine, Mesopotamia, and Persia are extraordinarily infected.

An attempt has been made to formulate a general law that Trachoma diminishes from south to north.[1] There are so many exceptions to this rule—to mention only the United States, Canada, Finland, and Siberia—that no distinctive influence can be attributed either to latitude or climate. Thus, in a Trachoma country like Egypt, Europeans scarcely ever suffer from the disease.

High altitudes are said to be a great protection against Trachoma, and Chibret has declared that it occurs only sporadically at an altitude of 200 metres above the sea level. This statement is true, with certain restrictions and exceptions, for Europe, but not for other parts of the world. Switzerland and Tyrol, for example, are comparatively free; but no doubt the lower population, diminished intercourse, and larger water supply are all factors which reduce the possibility of infection among the mountains. Moreover, we have seen that in Hohenzollern, Bayreuth, the Eichsfeld, Biedenkopf near Marburg, Upper Silesia—all at a height of 400 to 600 metres—the disease is fairly prevalent. In the Caucasus, at an altitude of 2,000 metres, Trachoma forms 8 per cent. of all eye diseases. There is no doubt that altitude in itself does not afford any immunity. This is also borne out by the observations of Collins, Burnett, Viger, and van Millingen.[2] Further, when

[1] *Hourmouziadès*, De la conjonctivite granuleuse. Paris 1902, S. 71.
[2] Zentralblatt für prakt. Augenheilk. 1899, S. 501.

Trachoma has once invaded mountainous districts, it can flourish there and spread.

We come now to the much-disputed question of *race*. In 1876 Burnett, of Washington, drew attention to the immunity of the negroes in the United States, and asserted that altitude and hygienic conditions were of no importance as ætiological factors, but simply the influence of race. The predisposition which is essential for the growth of Trachoma, and, in contradistinction to this, immunity against its development, show, according to Burnett, that it must be something more than a local, purely contagious affection. America, with its cosmopolitan population, offers a good area for investigation. The whites are often affected, especially Jews, Irish, Italians, and Scandinavians. The Chinese suffer as much as they do in China. Even the Indians, contrary to the observations of others, are not exempt, any more than pure, native-born Americans. The negroes alone can be regarded as almost immune. In fifteen years Burnett saw only six suspicious cases of Trachoma among 10,000 negroes' eyes. The negroes, moreover, live mostly crowded together in unhealthy regions, and are very subject to tuberculosis and scrofula, which also affects their eyes.

At the tenth International Congress, held in Berlin in 1890, it was suggested that an International Commission should be formed to inquire into the racial and geographical distribution of Trachoma. As this proposal fell through, Chibret in 1896 instituted a similar inquiry in France at the instance of the French Ophthalmological Society.[1] He propounded the following three problems—the cause of Trachoma, predisposition, and meteorological conditions. As regards cause, most of the observers admitted a micro-organism, all admitted the contagiousness of the disease, and rigorously differentiated follicular conjunctivitis from Trachoma. According to Chibret, meteorological conditions play only a secondary part; high

[1] Zentralblatt für prakt. Augenheilkunde 1897, S. 155.

altitude and sea air diminish susceptibility, while heat and drought increase it. Chibret firmly believes in racial predisposition. Yarr [1] is of the same opinion; he distinguishes three grades of susceptibility—the susceptible, the relatively immune, and the absolutely immune races. The first class includes the Chinese and Japanese, among whom Trachoma forms 75 to 78 per cent. of all eye diseases, and of white races, the Jews, Poles, Italians, and Irish. The full-bred negroes of the United States, Senegambia, Guinea, and West Africa, as well as the natives of Ceylon, are relatively immune. The absolutely immune include the Canadian Indians and Eskimos, and the Cris and Santeaux of Manitoba, who live in close proximity to the very susceptible Russian Mennonites. The Red Indians of the United States, on the other hand, belong to another race, and are not immune.

Immune races may become susceptible in a hot, dry climate, and susceptible people may become immune where the climate is cold and damp. According to Yarr, all other influences, such as poverty, dirt, bad food, etc., are of far less significance than race, while climatic and meteorological influences are only of secondary importance. In Cuba the susceptibility of negroes, whites, and Mongols is as 1 : 4 : 7. In Java the Chinese suffer much more than the Malays.

Emile Berger [2] and Chibret assert that the Celts enjoy relative immunity. From statistics Berger comes to the conclusion that the Aryan races are less susceptible than the Semitic, and that among the former the Celts are least susceptible. He also thinks that it is proved that transmission of infection is least common among the French, commoner among other Aryans—*e.g.* the Austrians—and commonest among the Jews; moreover, in the Aryan races the disease runs a milder course, and more frequently affects only one eye.

Chibret, of Clermont, who had asserted at the Interna-

[1] *Yarr*, British Med. Journ. 1899, May 6th.
[2] Zentralblatt für prakt. Augenheilkunde 1896, S. 541.

tional Congress at Copenhagen, in 1884, that in Belgium, Switzerland, and France Trachoma was no longer contagious at an altitude of more than 200 metres, propounded the following law at the Berlin Congress in 1890[1]: "The normal trachomatous virus, which is very slightly virulent for individuals of the Celtic race, loses all virulence for that race after transmission through a Celt." He seeks to prove this law by the anthropology, geography, clinical features, and history of the disease. With regard to history, the chain of argument is remarkable. After Buonaparte's Egyptian campaign the infected French soldiers could not spread infection either among the French troops or the French population, simply because the virus had become attenuated for the Celtic race, while it spread very readily among other armies. Larrey had already observed that Trachoma was more common among blondes than among dark people, and the Celts of to-day belong to the latter category. Statistics have proved, however, that Trachoma is quite as common in France as in Germany, and that the Irish, who are Celts, are very prone to the complaint. Finally, according to the researches of Elbe, Arlt, Sattler, and Hirschberg, Trachoma has been endemic in certain parts of Europe for centuries, and was not conveyed to any appreciable extent by French troops to other armies and peoples. The fact that it has perceptibly declined in France within the last decade is possibly due not so much to the immunity of the Celtic race as to comparative social improvement. We must note, however, that Chibret claims only a relative, not an absolute, immunity for the Celts. Since the non-infected areas which he cites are almost all at a high altitude—*e.g.* the central plateau in France, the Ardennes in Belgium, the Bavarian highlands, etc.—it is more natural to assign the cause to altitude rather than to racial immunity.

After all that has been said, we cannot admit that race is of any decisive importance as an ætiological factor, and we

[1] Verhandlungen, etc. Bd. IV. Abt. 10, S. 23.

certainly cannot go so far as Chibret in asserting that the ætiology of Trachoma is dominated by race.

The present position of the controversy is that almost all statements as to racial immunity are subjects of dispute. At the French Ophthalmological Society, in 1896, de Gouvea[1] denied the immunity which is claimed for negroes, because in South America, where the negroes are of the same race as those in North America, the disease is very prevalent among them. The negroes of North America are less exposed to infection, because they are debarred from all intercourse with the white population. In Brazil, Turkey, Egypt, and South Africa they are more exposed to the contagion, and as a matter of fact suffer greatly. Nor can it be maintained that the Jews exhibit any peculiar predisposition to the disease, for while it is very common among ignorant and dirty Polish Jews, it is rare among the more cultured and civilised Jews of Hungary.

So, too, Abadie, Pechdo, Galezowski, Vennemann, and Feuer deny the theory of racial immunity, pointing out the decisive importance of contagion and bad social conditions. It may be expected that future inquiries will prove more and more clearly that no true ætiological value can be attributed to the influence of race in itself.

In looking back upon the various ætiological factors that have been discussed, we find that Trachoma must be regarded as a contagious disease, the cause of which is presumed to be a specific micro-organism not yet conclusively demonstrated. We know that infection is conveyed by the conjunctival discharge, either by touching the face with contaminated fingers or by the common use of infected towels, handkerchiefs, etc., or water or washing utensils, but never by the atmosphere. It is not absolutely, but only conditionally, contagious—*i.e.* before infection can occur, there must be a *causa interna morbi*, an individual susceptibility or predisposition, which is probably fundamentally due to the peculiar structure of the palpebral

[1] Zentralblatt für prakt. Augenheilkunde 1897, S. 157.

conjunctiva with which the discharge comes in contact. This peculiarity is a tendency to the formation of adenoid tissue, and it is found particularly in chronic conjunctival affections and certain constitutional diseases, chiefly scrofula. The adhesion of the virus and the spread of the disease are enormously favoured by heat, foul air, dust, overcrowding in wretched hovels, bad hygienic and social conditions, especially want of cleanliness, indolence, and ignorance—in fact, by the habits of the lower classes. Trachoma is principally a disease of the proletariat, and usually slowly spreads among the members of the family circle.

As regards the spread of Trachoma, there has long been an active relationship between the army and the civil population. Standing armies, which offered an exceedingly fertile soil in virtue of the many injurious concomitants of the military life both in peace and war, acquired the disease from infected recruiting districts, again returning the gift redoubled to the populace. In all kinds of isolated institutions Trachoma, once admitted, rapidly spreads.

The spread of Trachoma is further favoured by climatic, geographical, telluric, and commercial conditions. It thrives best in warm climates, under the influence of heat and dust, in low-lying places, along the valleys of large rivers, in swampy ground, by lakes and fens, and on the sea-coast. It is rightly claimed that a high altitude affords some protection, but when once introduced into the mountains it can obtain a firm hold. Commercial intercourse influences its spread in so far as it brings people into intimate contact. In recent times migratory workmen have much helped to transmit the disease.

The question of racial predisposition is of no practical importance, at least in Europe. The most important factors are the chance of infection and individual predisposition, and race comes into account only in so far as the people are dirty and uncultured. The social status of a community may be gauged by the distribution of Trachoma in it.

CHAPTER V

DIAGNOSIS

As we have already had frequent occasion to remark in the last chapter, the ætiology of Trachoma is still an unsolved problem; consequently there are many points in the diagnosis of the disease which offer difficulty. In view of the fact that during the last twenty years or more the specific cause has been sought in vain by many eminent workers, the results having hitherto proved to be invariably wrong, we cannot ignore the conclusion that diagnosis is for the most part a matter of clinical symptoms.

Since the disease frequently has a long latent period, going on for months and even years without any marked subjective symptom, and is almost invariably confined to the lower classes, it is easy to understand why we seldom see the initial stages, diagnosis being most difficult at the commencement, when clinical symptoms are least obvious.

Hence it happens in practice that inexperienced observers not infrequently fail to detect Trachoma in its initial stage, or perhaps still more often diagnose it wrongly, thus causing unnecessary alarm. We will first consider the typical chronic form. To avoid missing it at its commencement, it is absolutely essential to make a methodical and careful examination of the whole conjunctival sac. Clinical experience has established the fact that the formation of granulations is for a long time confined to the retrotarsal folds, and as P. von Walther [1] pointed out more than eighty years ago, the lower

[1] *P. v. Walther*, Journal d. Chirurgie und Augenheilkunde 1821, Bd. II. S. 127 ff.

fold is first affected in about 60 per cent. of the cases, usually near the outer or inner canthus. The upper fold is first affected in only 28 per cent., the inner canthus being again first attacked. In about 9 per cent. the disease begins in the semilunar fold[1]; either the fold alone, or with it a small part of the adjoining fornices, is involved.

It is important to bear in mind that the appearance of fully developed follicles is preceded by the formation of small greyish yellow spots, the size of a pin's head, in the deeper part of the conjunctiva, there being scarcely any sign of inflammation. These pale spots, the so-called primary or elementary granulations, gradually develop into round, projecting, yellowish red granules or follicles, and the amount of subsequent inflammatory change in the conjunctiva depends upon the size and number of these follicles, and upon their slower or more rapid efflorescence.

Now, although it has been conclusively established that histologically identical follicles may occur in a host of other conjunctival affections, and might therefore apparently give rise to very considerable difficulties in diagnosis, practically the only difficulty is in the case of follicular conjunctivitis.

After all the discussion on the question of the separate existence of this disease, we shall strenuously adhere to the dualistic theory until the matter is definitely settled by bacteriological research, and we do so on practical and clinical considerations, having due regard for prognosis, prophylaxis, and treatment. Hence we do not agree with the unitarians that every follicle is trachomatous, but only accept those as such which lead to permanent injury to the eyes.

Accordingly we would clinically apply the term Trachoma to any granular conjunctivitis which has led to obvious hypertrophy or thickening, including, of course, the gelatinous and cicatricial cases. On the other hand, we would class as follicular conjunctivitis those cases in which the follicles lie in a soft, perhaps slightly congested,

[1] *Kuhnt*, loc. cit. S. 3.

but transparent conjunctiva, with no visible hypertrophy. The follicles in the latter case are usually less numerous, and are comparatively small; they have a glassy, transparent appearance, a well-defined outline, and do not usually occur on the upper lid. They seem to be on the conjunctiva rather than in it, and have no tendency to spread; they are frequently horizontally oval, arranged like a row of pearls; they seldom affect the tarsal conjunctiva, and even then rarely extend over the anterior part. Trachoma follicles, on the other hand, are round, large and coarse, grey or greyish yellow in colour, less transparent and well defined; they are frequently confluent, lie deep in the tissues, often in several layers, one above the other, always affecting the upper lid, and becoming softened at a later stage. The presence of these follicles in the region of the convex margin of the upper tarsus or fornix is particularly characteristic.

In follicular conjunctivitis the conjunctival connective tissue is never seriously affected, nor is the papillary body so often involved as in Trachoma. The conjunctiva retains its transparent, smooth, and frequently pallid appearance even when the disease has lasted a considerable time, while in Trachoma it soon loses its transparency, becomes thickened, and shows uniform congestion, papillary swelling, roughness, and large granules, the retrotarsal folds bulging forwards as huge swellings when the lids are everted. Mandelstamm,[1] of Riga, thinks that as long as the follicles keep to the superficial layers of the conjunctiva it is not Trachoma; when, however, the tarsal conjunctiva is also affected, and the follicles lie deeper in the adenoid tissue or tarsus itself, the case is one of true Trachoma. He holds that implication of the tarsus in Trachoma is of at least as great importance as that of the conjunctiva. According to Schmidt-Rimpler,[2] it is not Trachoma as long as the upper lid continues free from follicles: in other respects the

[1] Comptes-rendus du XII. Congrès international, Vol. VI. S. 132.
[2] Ibid. S. 134.

shape and appearance of the granulations, and particularly the character of the conjunctiva between them, will enable one to make a diagnosis.

In follicular conjunctivitis the essential feature is that after a longer or shorter period the follicles disappear completely, often without any treatment or only of the simplest kind, leading to no permanent injury to the mucous membrane. They do not undergo any characteristic transformation, and never lead to scarring. Trachoma follicles, on the other hand, as we have seen, undergo very definite and characteristic changes, culminating in cicatrisation, or a cirrhosis of the conjunctiva, with various sequelæ, such as pannus, corneal ulcer, leucoma, anterior staphyloma, secondary glaucoma, entropion, trichiasis and distichiasis, and xerophthalmia.

Trachoma therefore presents a quite typical and characteristic clinical picture, though this does not preclude the possibility of considerable variation and gradation in individual cases. Generally speaking, the attack will be severe, according to the number of follicles over the palpebral conjunctiva and retrotarsal folds, and to the amount of infiltration of the tarsus.

Ætiologically these two diseases must be sharply distinguished. We know that swelling of the follicles may appear as a reaction to irritants of various kinds, such as dust, foul air in schools, dirty eye-washes, etc. These sometimes give rise to follicular conjunctivitis, especially in anæmic and scrofulous persons, but never to Trachoma. Various authors claim that they have not infrequently observed follicular swelling associated with ametropia, as well as excessive eye-strain, without any other cause. Again, infection with the diplococcus of Michel sets up certain forms of follicular catarrh, as we have seen, but not Trachoma. Finally, we must keep to the fundamental fact that Trachoma never arises from follicular conjunctivitis without the addition of a specific virus. As far as can be established at present, Trachoma arises only through

infection with the conjunctival discharge from a case of Trachoma.

Follicular conjunctivitis, too, has a much wider distribution than Trachoma. In all parts of Germany, for example, it is more or less frequently met with, whereas in many districts Trachoma is found only in rare and exceptional cases.

Moreover, the fact that within the last twenty years Trachoma has greatly decreased in many places—*e.g.* in Breslau[1]—while follicular conjunctivitis is as common as ever, is positive proof that the two diseases are essentially different in character.

A conference was convened in Berlin in 1896 by the Royal Prussian Ministry of Public Instruction to consider measures for combating Trachoma, which was endemic in the provinces of East and West Prussia. At this conference all the university teachers present, including those who had practised in districts free from Trachoma, as well as those from affected districts, supported the dualist theory (Förster, Hirschberg, Kuhnt, Schmidt-Rimpler, Greeff, and Axenfeld). At the twelfth International Congress, at Moscow, in 1897, scarcely any one advocated the unitarian view except Mandelstamm, of Kieff; and at the conference on Trachoma held at Königsberg in 1898, the members were unanimous in their support of the dualist theory[2]—they held that follicular conjunctivitis was a harmless condition as compared with Trachoma.

In order to make the differential diagnosis clearer, Kuhnt's three types of follicular catarrh may be mentioned.[3] The first form is simple follicular swelling, in which vesicular granules appear on the healthy or slightly congested lower lid and fornix, the rest of the conjunctiva being normal. This stage is, properly speaking, not a catarrh, since there is no secretion; hence it is spoken

[1] *Schlesinger*, Wochenschrift für Therapie und Hygiene des Auges 1899, No. 42.
[2] *Kob*, loc. cit. S. 16.
[3] *Kob*, loc. cit. S. 15.

of as simple follicular swelling or folliculosis. It is frequently found fortuitously in schools, barracks, etc., as a perfectly innocuous condition. It formerly went by the name of "primary granulations," and was erroneously regarded by Löffler in 1849 as the initial stage of Trachoma. This harmless school complaint was pointed out by H. Cohn[1] in 1877. The second form, according to Kuhnt, is follicular swelling with catarrh, a simple catarrh supervening as a complication.[2] The third form is follicular conjunctivitis, in which, with all the signs of an inflammation of the conjunctiva, follicles—*i.e.* bleb-like, rounded bodies—develop in the lower fornix. These cases are often suspicious in trachomatous districts, and require careful watching.

Supervision is particularly necessary for those not infrequent cases in which, on everting the upper lid thoroughly, follicles are also found in the retrotarsal fold, especially in the corners. They heal, however, very readily under suitable treatment—1 per cent. silver nitrate solution, etc.—a fact that militates against the diagnosis of Trachoma. If the follicles are found in the lower fornix and are permanently confined to that situation, Trachoma may be excluded.

It may seem superfluous to draw special attention to very careful and thorough examination; yet there is some justification, considering the number of cases in which Trachoma is wrongly diagnosed or overlooked.

In his lectures on Trachoma, Greeff[3] was right in attaching great value to the preliminary examination of many normal conjunctivæ, for it is only by so doing that one can accurately appreciate the commencement of a pathological condition.

[1] *H. Cohn*, Zentralblatt für Augenheilkunde, Mai 1877.

[2] So-called conjunctivitis sicca is equally innocuous: in it the upper edge of the upper tarsus is reddened and finely stippled, owing to numerous minute papillæ and small granules. A. Peters is inclined to consider many cases of conjunctivitis sicca abortive forms of Trachoma, but the number of observations is too small to determine this point.

[3] *Greeff*, loc. cit. S. 7.

In slight cases the use of lateral illumination is helpful, or even the loup, combined with focal illumination.

The first indispensable point is to expose every portion of the conjunctival sac to view. It is a matter of individual taste what method is used to evert the upper lid, provided that the whole of the fornix is well exposed, and that the manipulation is not so severe or prolonged as to cause hyperæmia, and so obscure the true condition.

The following method, which Kuhnt [1] and many other experts practise, is to be specially commended for diagnostic purposes, where large numbers of patients have to be examined. On making the patient look down, seize the cilia with the thumb and forefinger of one hand, and draw the lid firmly downwards and away from the globe. With the other hand place a sound, glass rod or thin pencil on the part of the lid which lies over the convex border of the tarsus and adjoining fornix; push it well downwards, without pressing on the globe, and at the same time raise the ciliary margin as quickly as possible. This takes less than a second to do, and does not interfere with the appearance of the conjunctiva in any way. The whole of the fornix can then be examined at a glance.

Many recommend the eversion of the lid a second time by means of broad forceps. This takes more time to carry out, is a painful procedure, sets up considerable irritation, and is not a desirable method for purely diagnostic purposes.

Aided by the symptoms which have been enumerated, we shall usually be able to diagnose commencing Trachoma from follicular conjunctivitis at once: when the disease is fully developed the diagnosis is much easier.

Nevertheless, it must be admitted that doubtful cases occur in which the diagnostic features are less pronounced. In the few doubtful cases in which no reliable diagnosis can be arrived at after the most careful examination, all the circumstances of each case—the external conditions, etc.—

[1] *Kuhnt*, loc. cit. S. 10.

must be taken into account. If the case occurs in a place infected with Trachoma, the further course will soon prove the point. On the other hand, if a few suspicious cases are met with during the examination of a school amongst a large number of healthy children, with only mild follicular swelling, in a Trachoma-free district, the chances are against the cases being Trachoma.

In all doubtful cases a diagnosis is at first withheld, the patients being looked upon as Trachoma suspects. They are put on some mild treatment, as for follicular conjunctivitis, so as to avoid injury by too drastic applications; but preventive measures are adopted as if they had Trachoma—*i.e.* they are so isolated, as to render the spread of infection impossible. If they soon recover under simple treatment, they are not suffering from Trachoma. If it is really Trachoma, it will not be long before all the signs are apparent. All experienced observers lay stress upon the fact that even in these cases the diagnosis can only remain in doubt for a short time—at most, a few days.[1]

Trachoma shows so much variability in the severity of its onset and course in different cases that the mere diagnosis of Trachoma is not sufficient, especially in the examination of large numbers of people, as scholars, soldiers, etc. It is necessary on practical grounds to distinguish different classes according to severity, so that suitable therapeutic and prophylactic measures may be adopted. We distinguish four classes, following the plan of Hirschberg[2] and Greeff.[3] The first class includes the suspicious cases (A), which must be watched for some time before arriving at a certain diagnosis. The second comprises the mild cases (B), with moderate hypertrophy of the conjunctiva, a few granules in the retrotarsal folds,

[1] Cf. *Kuhnt*, Ueber den Heilwert der mechanischen Methoden in der Therapie der Conjunctivitis granulosa, 1899, S. 2. *Schmidt-Rimpler*, Berl. klin. Wochenschrift No. 1.

[2] *Hirschberg*, Ueber die körnige Augenentzündung, etc. 1897, S. 5.

[3] *Greeff*, loc. cit. S. 18 f. und 67.

the tarsus intact, and no secretion. The third comprises moderately severe cases (C), showing numerous granulations on both lids, including the tarsus, the upper fornices being considerably swollen, and secretion present. The fourth comprises the severe cases (D), already exhibiting sequelæ —pannus, entropion, trichiasis, etc. When the examination is completed, an indication of the class is put opposite the names in the records—A, B, C, D. This greatly facilitates comparison at subsequent examinations.

It happens, however, not infrequently in practice—leaving schools, etc., out of account—that there is difficulty in diagnosing early chronic Trachoma, because the symptoms in the initial stage are so slight, giving the patient so little trouble that a doctor is not consulted.

When Trachoma has lasted some time it can often be detected by a careful observer by a single symptom, though no other complaint is made. This is the very characteristic and commonly too little regarded ptosis, resulting from hypertrophy of the conjunctiva or infiltration of the tarsus. Even if there is absolutely no sign of inflammation, this should prompt one to examine thoroughly the whole conjunctival sac in every case.

We have already said that the diagnosis of Trachoma is much easier in the later stages. We cannot look upon a case as Trachoma unless there are granulations on the upper lid, with distinct thickening, infiltration, or papillary hypertrophy of the conjunctiva. The most typical site for the follicles is at the convex edge of the tarsus and in the upper retrotarsal fold. The diagnosis will be absolutely certain when the conjunctiva becomes gelatinous, pannus and scarring supervening in the later stages.

The symptoms of gelatinous Trachoma have already received attention in Chapter III. The gelatinous change in the conjunctiva does not set in until the second stage, when retrogression commences; it occurs most frequently after great eruption of follicles and diffuse infiltration of the adenoid tissue consequent on extreme obstruction to the

flow of blood in the stretched membrane. This gelatinous condition is often absent throughout the whole course of the disease; but when it occurs it is very characteristic.

Pannus is also not a constant symptom. It is found in the Trachoma districts of Germany in about 36 per cent. of cases, and in Russia in 52 per cent., according to Neese,[1] of Kieff. We agree with Raehlmann[2] in considering pannus not merely an extension from the lids but an independent corneal Trachoma, beginning with small circumscribed infiltrations. We presume that there is an individual predisposition for its onset, due to a scrofulous diathesis or abnormal metabolism. It is well known that pannus almost invariably begins as a crescent at the upper edge of the cornea, frequently spreading gradually towards the centre as a diffuse superficial, or even deep, very vascular infiltration.

This typical pannus is always presumptive evidence of Trachoma, and the diagnosis is made certain if the upper lid at the same time presents a granular or scarred appearance. In rare cases a scrofulous pannus resembles it. This, however, is most found in scrofulous children, with swollen glands, skin eruptions, phlyctenules, scrofulous marginal keratitis, especially fascicular keratitis. It starts irregularly from various parts of the cornea, and the conjunctiva shows no granulations or scars. In the very few cases in which diagnosis is doubtful, it is soon settled by the rapid improvement under general and local treatment of the scrofulous and phlyctenular condition.

When one or two cilia, growing obliquely, continually scratch the cornea they produce a superficial change sometimes resembling mild pannus; while other forms of marginal keratitis, healing vascular corneal ulcers, and leprosy at times produce a similar condition.[3] Thorough examination of the everted lid will eliminate error in all these cases.

[1] *Neese*, Deutsche med. Wochenschrift 1897, S. 684.
[2] *Martinson*, Diss. Dorpat, 1886.
[3] *Axenfeld*, Das Trachom, 1902, S. 11.

Trachoma in the second stage, if casually examined, has been and frequently still is mistaken for so-called chronic blennorrhœa, the chronic form of gonorrhœal ophthalmia, termed postblennorrhœic conjunctivitis by Leopold Müller.[1] The stage of Trachoma with copious secretion, follicles, and papillary hypertrophy has a surprising resemblance to the papillary hypertrophy following gonorrhœal conjunctivitis. Gonococci are as a rule no longer found in these cases, so that the diagnosis must be judged by the rapid improvement which results from the use of 1 to 2 per cent. silver nitrate, in conjunction with the history, and a thorough examination of the conjunctiva, cornea, and edges of the lids.

Scarring has always been regarded as one of the most important signs of Trachoma. A linear scar in the sulcus subtarsalis of the upper lid, parallel with and 2 mm. from its margin—the so-called Arlt's cicatrix—is particularly characteristic; fine cicatrices radiate from it towards the convex border of the tarsus. The retrotarsal folds become shortened from shrinking of the scars (symblepharon posterius), the upper fold being frequently drawn down over the tarsus.

The greater and deeper the diffuse infiltration and follicle formation, the more marked is the subsequent scarring. The traction of the scars and the shrinking of the conjunctiva produce the familiar trough-shaped curvature of the softened upper tarsus. Spasm of the orbicularishas already helped in the majority of cases to bring about entropion and trichiasis, with consequent mechanical injury of the cornea.

At the commencement of the third stage special attention and acute observation are required to avoid overlooking the small livid or transparent whitish lines of early scarring. Every one is aware that unequal compression of the conjunctiva on everting the lids produces anæmia of small areas, which may be mistaken for scars.

Even minute, faint scars, especially on the upper lid,

[1] *L. Müller*, Archiv. f. Augenheilkunde 1900, Bd. XL. S. 13.

confirm the diagnosis of Trachoma, in the simultaneous presence of follicles or typical pannus.

Axenfeld[1] rightly draws attention to the fact that in rare cases scars from mechanical and chemical injuries and burns may be mistaken for Trachoma scars, but the history would then serve as a guide; moreover, such scars are often unilateral, and more frequently affect the lower lid.

Again, the formation of cicatrices follows diphtheritic conjunctivitis in exceptional cases, as well as gonorrhœal ophthalmia and pemphigus. Here also the history should be inquired into. In diphtheritic and gonorrhœal conjunctivitis pannus does not occur, while in the latter it is only occasionally that faint scars are found in the fornices, never on the tarsus.

Pemphigus may lead to very marked scarring, and even to complete atrophy of the whole conjunctiva, giving rise to so-called essential shrinking of the conjunctiva, a condition similar to trachomatous xerophthalmia. The history, together with the presence of bullæ elsewhere, apart from the rarity of the complaint, will decide the diagnosis.

It is also easy to avoid confusing Trachoma with the scarring which ultimately follows from simple chronic blepharo-conjunctivitis with ectropion.[2] Here the scarring is confined to the conjunctiva near the margin of the lids, almost exclusively the lower lid, whilst there are no follicles, but at most a velvety or fine papillary surface.

Spring catarrh may simulate cicatricial Trachoma under certain conditions, owing to the milky-white appearance of the tarsal conjunctiva due to the proliferation of epithelium. This is, however, more diffusely uniform. The conjunctiva shows no scars in bands or cords, nor is there any incurving of the tarsus or pannus, but at most the typical glassy elevation round the limbus. The elevations on the palpebral conjunctiva have a flattened surface, giving them the appearance of a mosaic. The

[1] *Axenfeld*, loc. cit. S. 8.
[2] *Axenfeld*, loc. cit. S. 9.

history of recurrent attacks during the summer must be sought for.

Leaving the question of scarring, Trachoma must be differentiated from tubercle (Rhein, Fuchs[1]) and syphilis (Goldzieher and Sattler). Both may occasionally simulate Trachoma. Tubercular conjunctivitis is usually unilateral, and accompanied by distinct ulceration of the conjunctiva. Tubercle bacilli are present, and there is swelling of the preauricular and submaxillary glands. In doubtful cases inoculation of the rabbit's anterior chamber or the subcutaneous tissue of the guinea-pig will give a positive result. The history and the result of treatment will settle the diagnosis of syphilis.

The very contagious chronic diplobacillary conjunctivitis, which is common in Germany, and is due to the Morax-Axenfeld bacillus, is frequently associated with Trachoma in trachomatous districts. The discharge then contains diplobacilli, usually in large numbers, arranged in chains: they are generally devoid of a capsule, and are decolourised by Gram or Weigert. Follicles are never found in the pure affection, the conjunctiva being smooth or only slightly papillary. There is the characteristic redness of the skin at the canthi; hence the name angular conjunctivitis.

Finally, follicles may occur in leukæmia and pseudo-leukæmia. Mention has already been made of the follicular conjunctivitis which frequently arises after the use of eye-drops containing atropin, eserin, zinc, etc., disappearing after the drops have been stopped.

Such are the chief affections which have to be differentiated from chronic Trachoma.

In acute Trachoma, which is comparatively rare, there are similar difficulties in diagnosis. Cases are often met with in practice which are diagnosed as Trachoma, but are cured in a week or two by some simple lotion, not to mention the many school epidemics, submitted to drastic

[1] *Eyre*, Archiv für Augenheilkunde 1900, Bd. XL. S. 146.

treatment for Trachoma, which disappeared spontaneously on stopping all treatment, and were simply follicular conjunctivitis. Too much stress cannot be laid upon the fact that the outbreak of numerous cases of acute conjunctivitis in itself militates against the probability of its being Trachoma,[1] for acute Trachoma in this part of the world usually occurs only sporadically. We will now supplement the remarks made in Chapter III. by considering the differential diagnosis of acute Trachoma from certain other affections, including, besides scrofulous conjunctivitis (*Schwellungskatarrh*) and certain cases of traumatic catarrh, some forms of acute infectious conjunctivitis, the specific germs of which are well known.[2]

In scrofulous conjunctivitis the appearance of the conjunctiva, and particularly the papillary hypertrophy over the fornix, may at first suggest acute Trachoma. The occurrence almost exclusively in children, with other scrofulous signs, such as eczema of the lids and face, or phlyctenules, and the rapid recovery under appropriate local and general treatment for scrofula, render correct diagnosis assured.

Seeds of corn and cereals, blown into the conjunctival sac, may lodge under the upper lid and set up a violent inflammation with much swelling and papillary hypertrophy in the course of a few days or weeks. In such cases the inflammation occurs as a rule in one eye only, while the peculiar scratched appearance of the upper half of the cornea frequently suggests the presence of a foreign body. This is found on everting the lid and exposing the fornix, and is often tightly wedged in between the folds.

Cases have frequently been recorded in the literature, in which a very violent conjunctivitis, and what has seemed to be an epidemic of acute Trachoma, has occurred among woodmen, being due to the hairs of plants [3] or caterpillars.

[1] *Schmidt-Rimpler*, Einige Bemerkungen über Trachom, etc. 1898, S. 3.
[2] *Axenfeld*, loc. cit. S. 13.
[3] *Schmidt-Rimpler*, Zentralblatt f. prakt. Augenheilkunde 1899, S. 91.

Various authors, as Kuhnt, Greeff, Axenfeld, A. Roth,[1] mention acute artificial conjunctivitis intentionally set up by lazy and hysterical people, and by young men, with a view to avoiding conscription. This is caused by the introduction of irritants, such as horse dung, toilet pomade, tobacco, pepper, salt, and soap, or by frequent rubbing of the eyes with the fingers. In examining recruits, when the work is done hurriedly and an immediate decision is desirable, such a condition is sometimes mistaken for Trachoma. In these cases the inflammation is almost entirely confined to the lower half of the conjunctival sac, the upper half being more difficult to get at, and not infrequently the redness of the ocular conjunctiva is sharply defined by a horizontal line below the cornea. Sometimes particles of the substances used are found. In all doubtful cases the cause will be discovered if the patient is kept under observation for several days, the eyes being bandaged.

There are a number of cases in which a wrong diagnosis can only be avoided by making a careful bacteriological examination. From the numerous researches of the past twenty years we know that the same pathogenic organisms are met with in diseases of the eye which have long been known to cause other general and local complaints. As examples we may mention Neisser's gonococcus, the pneumococcus of Fränkel-Weichselbaum, the streptococcus and staphylococcus, the Klebs-Löffler bacillus, the tubercle bacillus, bacillus coli, bacillus ozænæ, the lepra bacillus, diplobacillus, aspergillus, etc. The efforts to draw up a new classification and nomenclature of eye diseases on the basis of bacteriological research have as yet been unsuccessful, since the clinical symptoms do not entirely correspond with bacteriological results.[2] There are still very few eye diseases in which we can specify a single organism as the cause.

Bacteriological research has shown that the cause of acute blennorrhœa is the gonococcus, whilst for various

[1] *A. Roth*, loc. cit. S. 274. [2] *Römer*, loc. cit. S. 35.

forms of simple conjunctivitis several bacteria have to be taken into account, such as the Koch-Weeks bacillus, the Fränkel-Weichselbaum diplococcus lanceolatus (pneumococcus), and the Morax-Axenfeld diplobacillus. The Klebs-Löffler bacillus, as well as streptococci and staphylococci, may be left out of account, as they play no part in the differential diagnosis of Trachoma.

It is well known that many cases of acute Trachoma resemble commencing purulent ophthalmia: the great swelling of the upper lid, the intense redness, and the swelling of the conjunctiva into folds which may conceal follicles, give rise to difficulty in diagnosis until the discharge is examined for gonococci. In exceptional cases of purulent ophthalmia no gonococci can be found[1]; moreover, staphylococci may resemble them in shape, but neither they nor the pneumococci are decolourised by Gram.

Gonococcic conjunctivitis is known to be very prevalent in Egypt,[2] where it often affects those suffering from Trachoma; in such patients it usually runs a mild course.

Conjunctivitis due to the Koch-Weeks bacillus may be mistaken for acute Trachoma. It is very contagious, and runs a rapid, mild course, with abundant secretion. It is very liable to break out in epidemic form, and is met with at times among Trachoma patients in trachomatous areas. This bacillus resembles the influenza bacillus, and is not decolourised by Gram.

Diplobacillary conjunctivitis is extremely contagious, so that it often attacks people with Trachoma; in itself it bears no resemblance to that disease.

The granulations in acute Trachoma are at first obscured by the conjunctival swelling, hence it is frequently mistaken for the types of conjunctivitis mentioned. It is not always possible to make a positive diagnosis from bacteriological examination, for various combinations of the

[1] *Axenfeld*, loc. cit. S. 15. [2] *L. Müller*, loc. cit. S. 51.

different kinds of conjunctivitis with Trachoma and follicular catarrh[1] occur, and include the secondary or superadded infection of Morax. If the bacteriological investigation gives a positive result, gonococci, pneumococci, or Koch-Weeks baccilli being found, the case is not likely to be acute Trachoma, though this cannot be excluded until the superposed conjunctivitis has passed off. Even on taking into account the external circumstances of the individual case, the diagnosis must often be left in abeyance. If the bacteriological result is negative or not characteristic, as in the case of the staphylococcus and xerosis bacillus, simple acute Trachoma cannot be diagnosed from the clinical features until the other forms of conjunctivitis, which at present have no characteristic bacterial basis, are excluded, especially scrofulous and traumatic conjunctivitis.

It is important to make the bacteriological examination at the proper time—*i.e.* when the discharge is at its commencement or at its worst—and not to wait until the inflammation is dying out, for in the early stages the specific organisms are numerous and predominate over other bacteria.[2] A simple cover-glass preparation is usually sufficient for diagnosis.

The ordinary pyogenic organisms (staphylococci) are found so frequently in the conjunctival sac that it is difficult to estimate duly their ætiological significance in conjunctivitis. Streptococci, which vary widely in virulence, the so-called bacillus ozænæ, and the bacterium coli occasionally cause simple conjunctivitis, but are of little significance.

In discussing the symptomatology of Trachoma we stated that A. Peters, of Rostock, believes from clinical observations which he alone has made that there are abortive cases of Trachoma, which appear as mild, chronic, dry conjunctivitis, without follicles or scarring, and without any characteristic organism. If this theory be correct, the number of suspicious cases would be enormously increased,

[1] *L. Müller*, loc. cit. S. 31.

[2] *Axenfeld*, loc. cit. S. 15.

and insurmountable difficulties in diagnosis would arise. Peters himself, indeed, gives no definite points whereby to settle the diagnosis; for he admits that "an increase of tissue indistinguishable from adenoid tissue" is not sufficient to justify the diagnosis of Trachoma. Nevertheless, it will be interesting to note whether his view will be borne out by further and more extended observations.

It is most important to diagnose accurately the stage of every case of Trachoma, for only then can we give a correct prognosis, judge the danger of contagion, and direct prophylactic measures and the line of treatment. In this connection we may recall the full description of the three stages given in Chapter III.

Finally, we may briefly discuss the question of recruiting soldiers, on account of the peculiar conditions and difficulties which beset army surgeons in diagnosing Trachoma.

It has long been established by grievous experience that the army derived its Trachoma from the inhabitants of infected districts, and, *per contra*, that the prevalence of the disease among the people was greatly increased by the discharge of time-expired or invalided soldiers. Hence regulations have for years been formulated in almost all standing armies for the rejection of trachomatous recruits. The only exception at the present day is the Russian army, for which men are enlisted even if they have Trachoma, as long as the cornea is not affected.

As regards the conditions which obtained in the Prussian army,[1] an inquiry was instituted in 1815 and 1819 by the chief of the medical department into the nature of Trachoma and the means of combating it; and with the object of suppressing the disease in the army, an order was issued by the War Office on July 19th, 1821, to the effect that all soldiers suffering from contagious ophthalmia were to be sent to their homes after all pain, inflammation, and discharge had passed off. This regulation was also approved

[1] Deutsche milit.-ärztl. Zeitschrift 1893, S. 144.

of in the order of the Kultusministerium of December 28th, 1821, in opposition to the civil authorities, on the grounds that there was no danger of infecting the people if the following measures were carried out—that the discharged soldiers be notified by the commanding officers to the district councils, in order that they might be duly supervised by medical officers, and that they be admitted into a military hospital in case of relapse. At the same time the councils were charged with the instruction of the public on the nature of the disease and the danger of infection. These regulations were drawn up in more stringent form in the order of August 8th, 1835, which is still in force.

As regards recruiting itself, only severe cases of Trachoma were formerly rejected, mild cases being admitted.[1] In accordance with the scientific standpoint which prevailed the regulations were generally kept, allowing relatively too much scope to the discretion of the inspecting surgeon. An extraordinary difference of opinion often arose over the passing of recruits between the army surgeons and the medical officers appointed by the council to examine them subsequently. Thus, in a report of the Royal Council of Gumbinnen of June 9th, 1880, it is stated that of 328 possible recruits from the district of Tilsit, rejected on account of Trachoma in the spring of 1880, not one could be notified as trachomatous in the subsequent examination by the council medical officer.[2] Similar differences of opinion occurred in other districts—*e.g.* Ragnit and Insterburg. The following explanation of this remarkable proceeding was given in the same report: The nature of the disease renders it possible for surgeons even to fail to diagnose it in every stage from a single examination, as it is easily confused with the less virulent follicular conjunctivitis. In any doubtful case every conscientious army surgeon will assume that he has to deal with the more

[1] *Kob*, loc. cit. S. 24.

[2] *Passauer*, Das öffentliche Gesundheitswesen im Regierungsbezirk Gumbinnen während des Jahres 1881, S. 74.

serious complaint, because the responsibility is too great in the face of the almost inevitable spread of Trachoma in the particular regiment if a recruit suffering from the disease is carelessly passed. Moreover, there is reason to think that many men wilfully neglect, if they do not actually aggravate, any slight conjunctivitis they may have at recruiting time, since they know well that there is no easier way of escaping military service than having some affection of the eyes.

In 1863 the following classification[1] of infectious diseases of the eye was issued for the use of Prussian army surgeons in their reports: (1) Primary granulations; (2) Granular conjunctivitis; (3) Acute blennorrhœa; (4) Chronic blennorrhœa; (5) Secondary granulations.

In order to facilitate as uniform a diagnosis of Trachoma as possible and to provide a clear and practical rule for the surgeon when inspecting recruits, J. Jacobson, on November 15th, 1880, issued as an official order his *Rules for the Examination and Diagnosis of Eye Diseases among Prospective Recruits*. In these rules Jacobson distinctly adopted the dualistic theory. He set down follicular and granular conjunctivitis as two separate diseases, and admitted primary granulations as a third. The text of this order was as follows[2]:—

In order to check the spread of infectious eye diseases in the army, as well as to guard young recruits from the danger of slight diseases being made worse, the following rules are to be adhered to on examination:

I. Cases to be Rejected

1. Severe chronic conjunctivitis, with swelling of the retrotarsal folds and discharge.
2. Chronic blennorrhœa.
3. Follicular conjunctivitis of long duration or considerable severity. This includes:
   (*a*) All cases which, on everting the upper lid, show follicles on the retrotarsal folds.

[1] *A. Roth*, loc. cit. S. 194.
[2] Deutsche milit.-ärztl. Zeitschrift 1893, S. 147 and *A. Roth*, loc. cit. S. 194.

(*b*) Cases in which numerous follicles, usually arranged in rows, are found on the lower lid only, especially in the fornix, if accompanied by marked congestion and swelling.

4. Granular conjunctivitis proper, characterised by the presence of greyish yellow round elevations on the conjunctiva, especially of the upper lid. They must not be confused with the short, close-set prominences in the conjunctiva at the outer canthus, which are of absolutely no significance.
5. Diphtheritic conjunctivitis, as well as cases of more or less advanced disease of the conjunctiva, accompanied by destructive changes in it (scars, etc.), or in the substance of the lid.

II. Cases to be Passed

1. Acute and chronic conjunctivitis, with only moderate discharge (except I. 1), such as may be expected to be well before commencing duty.
2. Slight cases of follicular conjunctivitis, with normal upper retrotarsal folds.
3. Primary granulations—*i.e.* vesicles or follicles on a conjunctiva which does not exhibit any appreciable congestion or œdema, or any discharge,—indeed a more or less normal conjunctiva.

This order remained in force until 1893.

In the meantime the histological researches of Nuel, Jacobson senior and junior, and Raehlmann, in the eighties, threw considerable doubt on the correctness of the dualistic theory, and it was felt that the rules for examination should be simplified, for experience soon showed that it was often difficult to decide under which class granulations or follicles should be placed. Accordingly regulations were drawn up by von Hippel on March 4th, 1893, and these are still in use in the Prussian army. In them the unitarian theory was adopted, the distinction between follicular and granular diseases being again relinquished. The regulations are as follows[1]:—

RULES FOR THE INVESTIGATION AND DIAGNOSIS OF EYE DISEASE IN RECRUITS

The examination of the conjunctiva of the upper lid is of the utmost importance in judging the fitness of men for service, because

[1] Deutsche milit-ärztl. Zeitschrift 1893, S. 152f.

all affections of the upper lid must be considered more serious than those of the lower, and because the former not infrequently necessitate rejection. An examination of the upper lid must be made in all cases in which the lower lid is affected, however slightly.

I. Cases to be Passed

	Abbreviations for use in the Registers.
1. Acute catarrhal conjunctivitis.	Eyes K. I.
2. Slight chronic catarrhal conjunctivitis, with moderate amount of discharge and no appreciable swelling of the retrotarsal folds.	
3. Phlyctenular conjunctivitis.	
4. Follicular conjunctivitis. This class comprises those cases in which follicles are found solely or chiefly in the lower fornix and on the lower lid, the conjunctiva being healthy or at most only moderately congested and œdematous, with but slight discharge ; the conjunctiva of the upper lid being normal or minimally inflamed.	Eyes Gr. I.

II. Cases to be Rejected

1. Severe chronic conjunctivitis, with swelling of the fornices and considerable discharge, but an absence of follicles.	Eyes K. II.
2. Acute and chronic blennorrhœa, diphtheritic and gonorrhœal conjunctivitis, with their sequelæ.	Eyes Bl.
3. Severe forms of granular (follicular) conjunctivitis. This class includes all diseases—	Eyes Gr. II.
(*a*) In which follicles are found solely or chiefly in the upper fornix or conjunctiva of the upper lid.	
(*b*) In which there are numerous follicles on both lids, the conjunctiva being considerably altered and swollen, its transparency greatly impaired or gone, the epithelium irregular or partially absent, and the discharge copious.	
(*c*) In which changes have occurred at a later stage in the conjunctiva (scarring, papillary hypertrophy), in the lids (curvation, entropion, ectropion), or in the cornea (pannus, ulcers, infiltration, ectasia, opacities).	

For the past ten years these regulations have been in force not only in the Prussian army, but also in the sanitary departments. Although their introduction seemed at first to guarantee greater uniformity in the inspections and reports, the absence of a consensus of medical opinion on the subject has long been a matter of regret, and repeated and ever-increasing complaint has arisen against the practical utility of the regulations. Kuhnt,[1] while inclined to regard von Hippel's rules more suitable and practical than Jacobson's, states that it is frequently quite impossible to decide definitely between K. I. and K. II., and still more so between Gr. I. and Gr. II., especially during the rapid examinations of school children and army recruits. The inspecting surgeons were often greatly at a loss to know into which class to put cases, the result being that, shrinking from the risk, every doubtful or suspicious case was put under K. II. or Gr. II. The consequence was not only to deprive the army of many useful men, but also to arouse unnecessary alarm among the people, and to lay the foundation of misleading statistics.

In order to make better provision for the doubtful and suspicious cases—the so-called mixed and transition forms —Kuhnt thinks it necessary to introduce an intermediate division, using the terms K. I. s. and Gr. I. s. (s. = suspicious). In this manner it is easier to avoid error in diagnosis, especially that of classifying under Gr. II. (Trachoma) cases of simple follicular conjunctivitis, which appear more serious than usual through rubbing with the fingers, weeping, exposure to a dusty or smoky atmosphere, etc.

Heisrath,[2] in the case of class Gr. I., would distinguish F. and F. K.—*i.e.* follicular swelling with and without catarrh, follicles on a healthy or at most slightly inflamed conjunctiva—from Gr. I.—*i.e.* slight cases of follicular conjunctivitis in which there is little inflammatory swelling and follicle formation.

[1] *Kuhnt*, Ueber die Therapie der Conjunctivitis granulosa, 1897, S. 13.
[2] *Kob*, loc. cit. S. 25.

Hirschberg and Greeff [1] have proposed that in examining large numbers of people, only suspicious and undoubted cases of Trachoma need be recorded, classifying them as suspicious, mild, moderate, and severe; and that all other affections should be left entirely out of account, as being of no importance for the main object in view—viz. that of combating Trachoma.

Finally, a resolution was passed at the conference on Trachoma of June, 1898, that it is necessary to distinguish Trachoma (Granulose) from simple formation of follicles with or without catarrh.

There is undoubtedly reason for all these proposals which have just been mentioned. Nevertheless, it is impossible to conceal the fact that the absence of conformity in the views and decisions of the inspectors is due not so much to the manner in which the regulations are interpreted as to the nature of the disease, or rather to the incompleteness of our present knowledge of Trachoma. Even in the present state of science, there is still much to be desired in the diagnosis of Trachoma, whether from the unitarian or dualistic point of view. If diagnosis were clear and precise, no rules would be required. On the other hand, it is impossible to clear away the difficulties by merely drawing up new regulations. The deficiencies and difficulties in diagnosis, however, are not alone responsible for the difference of opinion; the want of experience and training on the part of the inspecting surgeons is largely responsible, a drawback which may be explained, and indeed excused, on the ground that very few universities have a sufficient supply of Trachoma cases for teaching purposes. This is very clearly shown by the wrong diagnosis of epidemics of Trachoma which have frequently been made in schools and similar institutions, and even in barracks, spreading alarm through wide areas, leading to the closure of schools, drastic preventive measures, and costly treatment, whilst the epidemic

[1] *Greeff* loc. cit. S. 16.

suddenly disappeared as soon as the disease was proved to be simple follicular catarrh.

None the less the regulations of 1893 require amendment. The vast majority of ophthalmologists at the present time disapprove *in toto* of the unitarian theory upon which they are founded. The abbreviations Gr. I. and Gr. II., the former denoting a harmless, and the latter a very serious conjunctival disease, both correspond on the unitarian theory with "Granulose"—*i.e.* Trachoma—and will readily lead surgeons of limited experience to regard these widely different types of disease as essentially the same, and hence to put down all doubtful cases without hesitation in the category Gr. II.—*i.e.* frequently to make an erroneous diagnosis of Trachoma. On the other hand, it would be of no practical value to alter the regulations so as to make only Gr. II. refer to Trachoma. The mistake of looking upon Gr. I. as a mild form of Trachoma, which may at any time become severe, is still made, as practical experience has shown. The author is of opinion, therefore, that only one course is open—viz. to render such a mistake impossible by altering the regulations. He would recommend that the words "granular (follicular) conjunctivitis, Eyes Gr. I." of No. I. 4, should be changed into the simpler "the milder follicular changes in the conjunctiva, without or with catarrh, Eyes F. and F.K."; and instead of "the severe forms of granular (follicular) conjunctival disease, Eyes Gr. II." of II. 3, simply "Trachoma, Eyes Tr." Since, however, the present state of our knowledge demands an intermediate class, doubtful cases might be designated "Eyes F.K. (Tr. ?)," and these cases might be accepted for the army, though it is of course advisable to reduce their number as far as possible by minute and careful examination. Still, it is better to have too many doubtful cases than too many wrongly diagnosed Trachomas.

These small alterations would not necessarily do away with all doubt and difference of opinion, but they would

certainly be more in keeping with the present ophthalmological standpoint, and would do much to relieve the practical inconvenience. The regulations need not contain all the varieties and grades of the diseases which may occur, nor should they replace diagnostic acumen; they should merely be an aid to the experienced surgeon in making important decisions, in this case as to the fitness of men for military service, thus facilitating him in applying the official regulations.

As regards the important subject of the examination of schools which has frequently been undertaken in recent years with the object of stamping out Trachoma, the author thoroughly agrees with Hirschberg and Greeff, that simply the true and suspected cases of Trachoma should be recorded as suspicious, mild, moderate, and severe. The use of von Hippel's rules is not to be recommended, since they unnecessarily complicate and obscure a subject which is in itself fairly simple and clear. Greeff,[1] who acquired great experience from the examination of numerous schools in the Trachoma provinces of Prussia, again and again emphasises the fact that the registration of simple and follicular conjunctivitis in schools leads to much serious annoyance. When children with these simple complaints are once included in the registers, they are submitted to quite unnecessary worry by the doctors or the teachers, the condition being often aggravated by the application of irritants and caustics. If treated along with other scholars who have Trachoma, they become infected. Their attendance at school is unnecessarily interfered with and their mental development injured. Finally, when every inflamed eye is recorded in the Trachoma registers, the statistics are utterly vitiated, and the official returns are many thousands too high.

[1] *Greeff*, loc. cit. S. 15 f.

CHAPTER VI

PROGNOSIS

ALTHOUGH Trachoma has gradually become decidedly milder in type since the Napoleonic wars and the epidemics which raged throughout most of the countries and standing armies of Europe immediately after them, it must undoubtedly still be regarded as an extremely serious disease. The time seems to have passed by for ever in which it spread rapidly in epidemic form, making fearful ravages, rendering thousands totally blind, and threatening to incapacitate whole armies. There have been no very acute epidemics for many years. Trachoma has become an extremely chronic disease, spreading slowly and almost imperceptibly among the lowest classes, on the soil of poverty and dirt, being difficult to check when once it has obtained a firm footing among the rural population.

We have already said enough on the insidious and terrible course which the disease takes in many cases. We saw that there were rare exceptions in which it became cured spontaneously, leaving no permanent tissue changes or serious impairment of sight. The latter results are, however, the rule, and they are the more serious because the disease is generally bilateral, and may go on for many years.

The misery which it entails on many a family is enormous. It is frequently just those members of the family on whom the others depend for their livelihood who, when infected, are for long rendered unfit for work, are again and again compelled by relapses to cease work, and are

ultimately made unable to resume it, on account of the serious sequelæ.

It is easy to understand how the incalculable duration of the complaint, its marked tendency to exacerbations and relapses, and the years of medical treatment and supervision that are necessary, as well as the meagre success which frequently results, have an excessively evil effect on the mental condition of the patients, and bring in their train most unfortunate circumstances which involve the ruin of domestic happiness.

Raehlmann[1] has recently pointed out that the part which Trachoma plays in statistics of the blind is usually much underestimated. The blindness is in many cases not complete, but frequently marked impairment of vision results from incurable opacity of the cornea, which, if not very dense, leaves the patient able to perform rough work, though in many cases it precludes the possibility of doing any at all. Since it is only the totally blind that are noted in the blind statistics, the great mass of people rendered unfit for work by Trachoma tends to escape the notice of the authorities. If this large class be included among the blind, as it certainly should be from an economic point of view, Trachoma would be the commonest cause of blindness after ophthalmia neonatorum and glaucoma; in Trachoma countries, particularly in Russia, it wrecks more eyes than any other disease. Raehlmann[2] has calculated that in the Russian Baltic provinces 96 per cent. of all Trachoma cases ultimately lose their sight to a greater or less degree; and in Belgium[3] the number that have become blind from Trachoma is stated to be over 9,000.

Thus in Trachoma countries the disease in the first instance reduces the capacity for work of a large percentage of the population, especially among the so-called

[1] *Raehlmann*, Ueber die Nosologie des Trachoms in Preussen, etc. S. 635.

[2] *Pröbsting*, Zentralblatt f. allgem. Gesundheitspflege, XV. Jahrg. S. 3.

[3] Académie royale de Belgique, Sitzung vom 25. April 1891. Cf. *Pröbsting*, loc. cit. S. 4.

working classes, and ultimately throws numberless persons, many even before they are grown up, on the public purse for the remainder of their lives. The national prosperity is thereby seriously crippled, both on account of the money spent on the support of paupers and disabled soldiers, and the great loss in the working strength of the nation.

M. Kirchner [1] rightly draws attention to the fact that the education of the people is seriously impaired in consequence of the frequency with which the schools have to be closed, while the fighting power of the nation is considerably reduced by the loss of thousands of trachomatous recruits. His statements are based on statistical reports of Prussia, and he comes to the conclusion that in view of the serious harm Trachoma works to the public welfare, it is at once a calamity for the district in which it occurs and a menace to the whole State.

In considering now the special prognosis of an individual case, the careful surgeon cannot but say at first in every case that it is doubtful and uncertain, even though he knows that with early diagnosis and proper treatment there is now a good chance of cure for a large proportion of cases. The course of a case cannot well be predicted at first, because not only epidemics but also individual cases show such varying intensity that it is well to maintain extreme caution.

Although every surgeon of experience in Trachoma countries has observed isolated cases which, without medical treatment, cicatrised spontaneously with clear corneæ and no incurvation of the lids, there is absolutely no doubt that the sooner proper treatment is adopted the better is the prognosis. Unfortunately, however, the disease usually begins so insidiously that the patients frequently do not come for treatment until a later stage—*e.g.* when pannus appears and sight fails—in which case the prognosis is materially worse. It is to be hoped that the institution

[1] *Kirchner, M.*, Die Bekämpfung der Körnerkrankheit in Preussen 1897, S. 7 ff.

of compulsory sick-funds in Germany will tend to secure early treatment for Trachoma patients.

When cases of this kind come under treatment, we judge of the prognosis from the type, stage, and extent of the process, as well as from the condition of the cornea. At the same time the general bodily constitution is thoroughly examined.

As regards the form of the disease, we can generally give a better prognosis in an acute case without complications than in a chronic one, in so far as experience teaches that complete recovery without scarring is still possible, though seldom achieved. Even early treatment can never absolutely ensure so favourable a result as this; it is only attained in exceptional cases with specially favourable relationship between the lymphoid infiltration and the condition of the blood. In most cases, as we know, acute Trachoma tends after some weeks or months to pass into the chronic form.

Further, we expect a case to run a favourable course when the follicles develop quite superficially, and the adenoid tissue is but little affected. The severe forms, having a malignant appearance from the outset, are characterised by the follicles being deeply seated, and often in layers one above the other. By their growth they stretch the conjunctiva, which itself exhibits well-marked diffuse infiltration; they also lead to considerable disturbances in the circulation and necrotic changes in the tissues.

The *condition of the cornea* is always a point of special —indeed, decisive—prognostic value. So long as it remains intact, there is hope of obtaining a satisfactory result by treatment, both as regards complete recovery from the disease, and maintenance of sight. If the cornea keeps clear, we can count on an ultimate cure under favourable external conditions within a reasonable period. If, however, there is well-marked pannus before treatment is commenced, a slow, dragging course, complicated by

unexpected exacerbations and endless relapses, is not uncommon, especially under unfavourable external conditions.

It is obvious that in an advanced case, with pronounced pannus, distortion of the lids, etc., the prognosis as to probable permanent cure and recovery of sight is very bad, although fortunately, by the more modern mechanical and surgical methods, very good results are often obtained even in cases that are extremely obstinate and apparently past all hope.

Although it may be generally considered a favourable result when a case goes on to cicatrisation without any severe complication or distortion of the lids, it would none the less be a mistake to assume that such a case is out of all danger. Relapses may occur from time to time even in a conjunctiva that shows a smooth, scarred surface and absence of all infiltration; corneal affections may yet ultimately supervene and seriously damage the sight.[1] Moreover, it is not uncommon for patients who are cured to become re-infected on their return to infected districts. We shall see later how carefully such fatal possibilities must be taken into account in treatment.

The cases of so-called *galloping Trachoma*, often reported from Russia, where the disease may lead to softening and necrosis of the cornea within a few days, are perhaps due to a mixed infection; but in more recent times they seem scarcely to have occurred in Germany.

The *general health* of the patient, his constitution, whether good or bad, are all-important for prognosis. Weakly, anæmic, and nervous persons, and especially those with a scrofulous or tubercular taint, are specially liable to infection with Trachoma. Moreover, in such individuals the disease runs a very violent and obstinate course, being frequently accompanied by unexpected exacerbations, and almost invariably by marked corneal affection. The other complications mentioned above, such as involvement of the

[1] *Axenfeld*, Das Trachom, 1902, S. 23.

tarsus, leading to distortion of the lids, severe blepharospasm, sometimes preventing effective treatment, disease of the lacrymal apparatus, are also particularly prevalent in persons of weak constitution. On the other hand, there is no doubt that a good constitution, though not absolutely proof against infection, is so little predisposed that the disease runs a mild course, and the patient recovers more quickly and more thoroughly on account of his greater recuperative power.

Narrowing of the palpebral fissures is a bad sign. Pathogenic micro-organisms and other injurious agents, when once they get into the eye, would in such a condition more readily remain; besides, it is a matter of daily experience that reflex spasm of the lids is then more severe and continuous, and produces considerable disturbance. This is of special importance in the development and continuance of sequelæ, such as pannus, entropion, and trichiasis.[1]

The *age* of the patient is important in so far as Trachoma in children is usually milder and is cured more readily, owing no doubt to their greater absorptive and regenerative powers. The scars are usually very fine.[2]

In discussing the various ætiological factors, we have already seen that the *dwelling-place* of the patient and his whole environment must be taken into account as of essential moment. From what has already been said, it is clear that the prognosis is worse if the patient lives in an infected district, where there is ample opportunity for re-infection.

It may further be taken for granted that an unfavourable *social status*, poverty, worry, wretched dwellings, poor nourishment, and unhealthy mode of life (especially want of cleanliness), constant work in a smoky or dusty atmosphere, ignorance and indolence, all make for a bad prognosis. On the other hand, a better prognosis may be given in well-to-do patients. They consult the doctor

[1] *Kuhnt*, loc. cit. S. 25.

[2] *Müller, L.*, loc. cit. S. 38.

sooner, because they pay more attention to health, and they are better able to avoid injurious influences. Moreover, they are in a position to remain long enough under medical treatment or supervision, or to remove out of an infected area. They are much less exposed to the risk of infection and much less liable to suffer from the sequelæ; hence it rarely happens that members of the upper classes become blind from Trachoma.

We shall see in the next chapter how much the prognosis is modified by the nature of the treatment employed.

CHAPTER VII

TREATMENT

A SURVEY of the history of Trachoma teaches us that local treatment was employed even in the oldest times, and that the methods in common use to-day are of very ancient origin.

In the collection of prescriptions in the Papyrus Ebers, at least 3,400 years old, we find verdigris[1] recommended as the chief agent, and lead acetate is said to have been much in use in ancient Egypt.[2] Ophthalmoxysis or blepharoxysis,[3] already practised by Hippocrates, and consisting in rubbing or scraping off the granulations with subsequent cauterisation, seems to have persisted throughout antiquity, and indeed to have been often overdone, for Celsus[4] especially remarks that this procedure should not be used too often, and should be reserved for severe and intractable cases. Hippocrates scarified with the prickles of Atractylis[5] wrapped round with Milesian wool; Alexander of Tralles, 560 A.D., with fig leaves, os sepiæ, or pumice stone. Paulus of Ægina removed the granulations with his raspatory (blepharoxyston), a spoon-shaped instrument. A kind of excision seems to have been used by Hippocrates,[6] and especially in the Middle Ages by Benvenutus Graphæus.

During the long period from the decline of ancient

[1] *Sattler*, Die Trachombehandlung einst u. jetzt. 1891, S. 176.
[2] *Raehlmann*, Ueber den Heilwert der Therapie bei Trachom, 1898, S. 5.
[3] *Sattler*, loc. cit. S. 175.
[4] De re media, VI. vi. 26.
[5] *Raehlmann*, loc. cit. S. 24.
[6] *Kuhnt*, loc. cit. S. 113.

medicine to the commencement of the trachomatous epoch at the beginning of the last century there are very few accounts of the treatment of the disease. G. J. Beer, in his previously quoted text-book,[1] includes some cases resembling Trachoma under "Eye-itch" (psorophthalmia), and recommends, besides cleanliness, abstention from fatty, indigestible food, and for the somewhat obscure "psora" inunction of a tartar emetic ointment into the affected parts of the skin and behind the ear. Larrey used local bleeding almost exclusively.

Cold applications, leeches, incisions, venesection and arteriotomy even to loss of consciousness, played the chief rôle in all European countries during the first twenty or thirty years of last century, and were often combined with counter-irritation, strong vesicants and moxæ, purges and diaphoretics, and confinement in a dark-room.

The demands of hygiene gradually received recognition, and the Englishman Vetch,[2] though a warm believer in venesection, as early as 1820 pleaded for fresh air and life in the open.

Among local measures, besides assiduous cleansing of the eyes, innumerable astringents were used, lead acetate, silver nitrate, and copper salts being already to the fore. Removal of the granulations with the knife and scissors were emphatically recommended by English (Vetch, Adams), Italian (Scarpa), and especially German authors (Rust, 1820; Philipp von Walther, 1821; later, Eble and Himly). By excision combined with hygienic measures, von Walther succeeded in rooting out a severe epidemic in the workhouse at Brauweiler, on the Lower Rhine, in 1818-21. He was so enamoured of the operation that he advised it in almost all stages, and even discussed its performance in the lower lid as a prophylactic measure. Over-enthusiasm and misuse, especially in England, soon brought the operation into discredit.

[1] *Beer*, Die Lehre von den Augenkrankheiten. Wien 1813.
[2] *Vetch*, loc. cit. S. 63.

Vetch, in 1820, advised a mild and cautious use of caustics. After 1835 the so-called abortive treatment of the Dutch military surgeons Kerst and Gobée gained a merely passing consideration. It consisted in energetic application of the caustic pencil; but the bad scarring which followed soon led to its being given up. Silver nitrate, copper sulphate, and lead acetate, however, obtained an appropriate place in the therapeutics of Trachoma after Albrecht von Graefe had pointed out in 1834 the exact indications for their use, and had uttered a warning against the abortive treatment. He used 1 to 2 per cent. solutions.

It is no part of our aim to give an exhaustive account of the present treatment of Trachoma; such an account would far transcend the limits of this work. For it we must refer the reader to the numerous text-books, as well as to the more recent and oft-quoted monographs of Sattler, Raehlmann, and particularly the excellent work of Kuhnt, whose accurate *exposé* is well-nigh indispensable to the physician practising in trachomatous districts. We shall confine ourselves to a survey of the more important features and the present condition of the question.

It is generally recognised that the purely medical treatment of moderately severe cases of endemic Trachoma is inadequate. According to Deneffe, continuous treatment demands 3 to 5 years; with the frequent corneal complications, 7 to 8 years; and if the treatment is interrupted its duration becomes unlimited. Fuchs,[1] Feuer, and others affirm that the chief difficulty lies in the long duration. Schnabel[2] remarks rightly: "The terribly long duration of the disease under the present methods of treatment is the weightiest cause of its increasing spread; improvement in treatment, thus cutting short the disease, is the essential role of prophylaxis."

Sufferers, who belong for the most part to the lower classes, lack the patience, the time, and the means, for sufficiently long treatment. Swayed by necessity and the

[1] *Fuchs*, loc. cit. S. 85.

[2] *Greeff*, loc. cit. S. 84.

inroads upon their time, they interrupt the painful treatment before the cure is complete. Relapses naturally result, and it is impossible to overlook the multitudes whose earning capacity dwindles more and more, whose lives are embittered, and who provide a fertile opportunity for the dissemination of the disease.

Th. Germann, in his already-quoted dissertation (1883),[1] sustains the thesis that chronic Trachoma is incurable; and Goldzieher,[2] in a recent paper, makes the ordinary treatment—especially that with copper—directly answerable for the interminable irritated condition and the whole train of complications.

The fundamental aim of all treatment of Trachoma, at any rate in trachomatous districts, lies in completely curing the disease in its earliest stages. The essential feature of prophylaxis is thereby fulfilled at the same time, and the spread of the complaint most effectually prevented.

For this purpose two chief therapeutic measures are available, the mechanical and the operative, and it is still a matter of dispute which of the two merits pre-eminence. The question seems to us to be purely theoretical. It cannot be answered alike for all cases, and the experienced practitioner will use both methods, according to the nature of the case, and will indeed show his judgment by combining them. In any event, treatment with medicaments, insufficient in themselves, is still essential in severe cases, both in quite fresh Trachoma, as well as after mechanical or operative interference, as will be seen in the sequel.

The treatment with medicaments now commonly adopted is essentially that evolved by Graefe and his pupils, extended and supplemented during the antiseptic period. An endeavour was made to free the conjunctiva as soon as possible from follicles, thereby acquiescing in the view (Saemisch)[3] that the follicles themselves need never be the

[1] *Germann*, loc. cit. S. 81.
[2] *Goldzieher*, Wiener med. Wochenschrift 1902, No. 9.
[3] *Saemisch*, Graefe-Saemisch, Bd. IV. S. 68.

object of direct attack, since this involves increased scarring. Resolution of the follicles by the natural means of absorption was aimed at. From the experience that this occurred much more frequently and easily in acute cases, but that an excess of inflammatory reaction endangered the cornea, von Graefe concluded that when the disease was very acute, the inflammation should be moderated and kept low, whilst in very chronic, torpid cases a moderate injection and inflammation should be excited and kept up, so that in each case the conditions most favourable for resorption might be brought about.

Hence, any excess of acute symptoms was combated by local application of cold, or by Jacobson's very efficacious method of scarification. This was followed by cautious application of weak astringents—chlorine water, solutions of lead acetate, zinc sulphate, or silver nitrate—with simultaneous use of atropin if requisite. Some early chronic cases, with follicles but no inflammatory symptoms, resolved under a purely hygienic and dietetic treatment, consisting in resting the eyes, cleansing them, avoidance of too prolonged treatment in hospital, plenty of fresh air, use of protective spectacles, improvement of hygienic conditions, etc. If the granulations became more numerous, owing to deficient reaction, one sought to excite inflammation with the copper stick, so as to aid resorption. In the stage of cicatrisation ointments were used to minimise the pernicious friction between the scarred conjunctiva and the cornea.

These principles are still recognised to-day, and solutions of silver nitrate and the copper stick still form the chief medicaments used, though they are unfortunately often misapplied. The danger of the use of silver nitrate as a caustic, even in the form of the mitigated stick, cannot be sufficiently emphasised. Much damage is brought about by these cauterisations, and the great scarring which follows them. An astringent, rather than a caustic, effect is to be aimed at, the inflammatory condition being restrained.

Hence we recommend silver nitrate in 1 to 2 per cent. solution only. This is especially indicated[1] in soft, succulent conditions, with marked swelling and injection. It is most efficacious when the conjunctiva is lax anddark red, with purulent or muco-purulent discharge—*i.e.* the more the condition approximates that of chronic blennorrhœa. The opposite condition, a rigid, firm swelling, with pale, yellowish red colour and muco-serous or scanty secretion, and also the hypertrophic, granular condition, with gelatinous or fleshy appearance, indicate the use of the copper stick.

Even this is subject to much misuse, being employed as a routine, and overdone. The stick should not be pressed roughly on the parts, but carried lightly and equably over the granulations, taking care to go well into the fornices, and to avoid touching the cornea. The fundamental principle is not to cauterise, but only stimulate.[2] Moreover, the technique of using the copper stick must be practised. Indiscriminate use for an excessive time is especially to be avoided, since too strong a reaction ensues, and directly militates against cure. Experience teaches that the copper stick often acts best when combined with expression.

The experienced practitioner changes the applications according to the exigencies of the case, and even stops all treatment for a time, often with advantageous results. Early slight cases or chronic torpid ones often do best under simple hygienic and dietetic treatment, without any applications.

Besides these two chief modes of treatment, which even now suffice for some surgeons, many other astringent, absorptive, antiseptic, and bactericidal substances have been recommended, such as lead acetate, tannin, boracic acid, carbolic acid, creolin, xeroform, resorcin, ichthyol, acetic acid, chromic acid, quinine, antipyrine, suprarenal extract, iodoform and other preparations of iodine, pyoktannin, naphthol compounds, and the new silver and

[1] *Raehlmann*, loc. cit. S. 6. [2] *Cohn*, loc. cit. S. 154.

copper preparations, as argentamin, protargol, itrol, cuprargol, and cuprocitrol.

Cold or lukewarm compresses of weak antiseptic solutions have proved useful, such as perchloride of mercury (1 : 10,000), boracic acid (2 to 3 per cent.), oxycyanide of mercury (1 : 2,500); so too when the discharge is copious, a mild ointment for the lids (1 per cent. yellow oxide of mercury, or boroglycerine lanoline, etc.) is useful to prevent their sticking together.

Subconjunctival injections, which raised great hopes for a time, have not proved satisfactory. Besides being very painful, they often caused the development of fibrous nodules, without succeeding in eradicating the supposed microbes in the tissues. On the other hand, the combination of mechanical treatment with antiseptics seems to be advantageous, causing deeper penetration of the drugs.

The old treatment with iodine has been much recommended in recent years. Nesmanoff[1] advises daily pencilling of the conjunctiva with 1 per cent. solution of iodine in glycerine or vaseline oil, and increases the strength later to 4 per cent. Roselli,[2] by the simultaneous application of potassium iodide and hydrogen peroxide, allows the iodine to act in the nascent state. The favourable results which have been reported have not, however, been confirmed, nor those of Ellinger,[3] who claims to have cured Trachoma in fourteen days by the instillation of mud-eel's blood into the conjunctival sac.

It may be mentioned, for the sake of completeness, that recently the light treatment has been recommended for Trachoma, after it had been found useful for new growths.[4] Two to three minutes' application of the rays with a power of six ampères is well borne by the rabbit's conjunctiva.

Experience has led to disabuse as to the treatment of

[1] *Nesnamoff*, Zentralblatt f. prakt. Augenheilkunde August 1897.
[2] *Roselli*, Comptes-rendus du XII. congrès international, etc. Sect. XI. S. 99.
[3] *Ellinger*, Geneeskundig Tijdschrift voor Nederl-Indie, 1902.
[4] *Strebel* and *von Ammon*, Deutsche med. Wochenschrift 1903, Nr. 23.

moderately severe or old cases of endemic Trachoma by medicaments. The scarcely shortened duration of the disease, the numerous complications and sequelæ, and the practical impossibility of carrying out the treatment efficiently, have gradually resulted in the abandonment of Saemisch's principle that the follicle is to be regarded as a *noli me tangere*. Attempts have consequently been made to attack it directly, to destroy it, or at any rate to eliminate its matrix, the diseased mucous membrane. Hence arose the mechanical and operative methods, which, although employed in antiquity, yet in their newest developments must be regarded as amongst the most important acquisitions of modern ophthalmic therapeutics.

These methods are used partly alone and partly in various combinations with drugs. A series of methods may therefore be distinguished [1]—purely therapeutic, therapeutic-mechanical, purely mechanical, therapeutic-surgical, chemical-surgical, mechanical-surgical, and purely surgical.

The value of the various methods of treatment is to be estimated according to their practicability, the rapidity and permanency of cure, and the protection they afford against relapse and reinfection. In consideration of the inherent tendency to cicatrisation, those methods must be accounted best which injure the tissues least.

From these points of view Keining's method of friction with corrosive sublimate, recommended in 1890, is found to be ineffectual in severe cases of endemic Trachoma, and to afford no protection against recurrence. Exhaustive investigations carried out in the Prussian army [2] in 1891 led to the conclusion that fresh cases were most suitable for Keining's treatment, since absorption of the follicles takes place quickest when the conjunctiva is vascular. The average duration of treatment was from two to six weeks. The most favourable result, 88·3 per cent. of cures

[1] *Kuhnt*, loc. cit. S. 89.

[2] Sanitätsbericht für die Preussische Armee 1890-2, S. 178.

in 400 cases, is partially explained by the prevalence of the unitarian theory, many cases of simple follicular catarrh being included in the statistics. In corneal complications the method generally failed, papillary swellings were not influenced, and chronic catarrh often persisted.

von Hippel,[1] too, carried out many investigations, mostly with favourable result. The pressure used in rubbing seems to cause both the superficial and deep follicles to become broken up and absorbed, whilst the Trachoma microbes are simultaneously destroyed by the sublimate. Only slight shrinking of the conjunctiva ought to follow. The duration of treatment varied from twelve days to five months.

Since the method is simple, and permits of the patient getting about, it is still often used, combined, if necessary, with scarification and expression. It seems to have proved most useful in follicular catarrh and many forms of so-called dry catarrh, as well as after excision or expression.

Amongst the purely mechanical methods massage is remarkably successful, though much undervalued. It is better able to cause absorption of the deleterious products through its action upon the blood and lymph-streams than any other bloodless method.[2] It has been very warmly recommended by Costomyris[3] since 1889, in the form of direct massage with the finger, boracic acid powder being spread over the conjunctiva and cornea. Others have used a glass rod (Prokopenko) or a spatula (Ottawa, Efimow), or have rubbed the everted lids against each other (Borissow), and kneaded the infiltrated tarsus (Misejewitsch). The method deserves more attention on account of its simplicity and indisputable results. It is not suited for the acutely inflamed cases, but is most useful in bringing about absorption of the last traces of infiltration,

[1] *von Hippel*, Verhandl. der XII. Sitzung der ophthalm. Gesellschaft zu Heidelberg 1891; *Bärenstein*, Zur Behandlung der follikulären Entzündung der Bindehaut 1892 (aus *von Hippel's* Klinik).

[2] *Boldt*, Deutsche milit.-ärztl. Zeitschrift 1900, S. 207.

[3] *Kuhnt*, loc. cit. S. 92.

especially in pannus and the opacities which result from it. Great improvement of the vision may often be obtained in this manner. Massage with Heisrath's ointment (potassium iodide, 1·0; sodium bicarbonate, 0·5; vaseline, 10·0) is well known and approved.

It is beyond the scope of this book to enter into details of all the other methods which have been devised; the reader is referred to the exhaustive treatises of Kuhnt. Abrasion of the epithelium (Peters) has a favourable but not very permanent effect. Scarification is not to be recommended, on account of the injury inflicted upon the conjunctiva—*e.g.* with von Schröder's metal brush, the so-called Russian brush, or the various scarifiers (Darier, Abadie, Manolescu, Dransart). Johnson's method, too, with many long incisions, followed by electrolysis, causes too much scarring, and has not received support. Sattler's method is better, and can be used in all stages, but it is somewhat tedious. It consists in scratching the surface of the follicle with a cataract needle, and scraping out the contents with a small sharp spoon, with the assistance of Herrnheiser's forceps.[1] The same applies to punctate cauterisation of the individual follicles with the galvano-cautery (Samelsohn).[2] Both Sattler's and Samelsohn's methods are adopted in slight or moderately severe cases to produce the most rapid and complete destruction of the follicles, with minimum injury to the rest of the conjunctiva, whilst also avoiding undue scarring. In severe and inveterate cases—*e.g.* with deep infiltration of the tarsus—these methods will not suffice alone. We must therefore give up all hope of discovering a radical and specific treatment for all forms and stages of Trachoma. The practitioner must make himself familiar with all the current methods, so that he may be able to determine the special indications in given cases.

The mechanical method of expression (*écrasement*)

[1] *Sattler*, loc. cit. S. 204 f.

[2] *Samelsohn*, Archiv f. Augen- und Ohrenheilk. Bd. III. S. 127.

rightly enjoys a considerable reputation. It has very rapidly put most other methods in the background, and is regarded as the best treatment for Trachoma by many authors, especially those who work in districts which are almost free from the disease. It is no new method, since it was recommended by Eble (1828), Pilz (1854), Cuignet (1878), and was probably used still earlier. The fingers or finger-nails (*unguipressio*) were originally used, then various instruments, forceps and roller forceps (Knapp, Schmidt-Rimpler, Kuhnt, and others). The method permits in many cases of very thorough elimination of the infiltrated masses with little injury to the tissues.

Expression causes the epithelium over the follicle to burst, the contents being expelled, so that the follicles are emptied without gross injury to the conjunctiva much more quickly than in the ordinary course of the trachomatous process. The procedure, the simple technique[1] of which will not be entered into here, is almost free from pain after submucous injection of cocaine. It permits of treatment in the out-patient department, removes the diffuse infiltration as well as the follicles, and prevents excessive scarring when employed correctly and at the right time. Care must be exercised during the first few days to avoid adhesion of the folds of conjunctiva, which are denuded of epithelium, by turning out the lids, or by the use of a blunt probe. Otherwise shortening of the fornices will occur, with the formation of pockets and cystic spaces.

The use of roller forceps is specially indicated when moderately large follicles occur without previous inflammation, or after the inflammation and discharge have subsided.

Most authors[2] advise expression when the follicles are "ripe"—*i.e.* softened. The procedure then gives good results, especially at the end of the first stage and in the

[1] Cf. *Kuhnt*, loc. cit. S. 104; *Greeff*, loc. cit. S. 86, *Schmidt-Rimpler*, Augenheilkunde S. 435.

[2] *Raehlmann*, loc. cit. S. 33.

transition to the second, also in early cases of gelatinous Trachoma.

In advanced gelatinous Trachoma the use of roller forceps easily causes serious injury, especially laceration of the fragile fornices, with much scarring. Kuhnt[1] therefore avoids them in this stage, as well as every form of traction, using only simple pressure. He has devised an "expresser" for this purpose, consisting of two alternately perforated metal plates. Since even the mere turning out of the lids causes injury in severe gelatinous cases, he has recently advocated very gentle expression with the lid in its natural position, by means of his "modified expresser," one of the plates of which is solid, the other perforated.

In all cases with actual infiltration of the tarsus, in addition to expression, he punctures the thickened tarsus deeply, particularly the convex border, with a Graefe knife, or with a special "puncturer." The tarsus is thus much relieved, and the cure considerably hastened. He has designed his expressers in various shapes—quadrate, rectangular, heartshaped—and sizes, so as to be able to reach the lurking follicles. Expression is completed when no follicles can be discovered after careful search with Westien's loup. After-treatment with medicaments is necessary, as after all other methods.

The author's own observations have confirmed the opinion that the use of roller forceps, correctly applied—*i.e.* to preserve the integrity of the conjunctiva before the commencement of scarring—is able to prevent the development of pannus and the shrinking due to cicatrisation. Too early expression, in the beginning of the first stage, must be avoided, since the hard, unripe follicles cannot be well expressed, the epithelial covering being insufficiently loosened. The mucous membrane is then mutilated, and sometimes an exacerbation results, probably due to escape of materies morbi into previously healthy tissues.

[1] *Kuhnt*, Zeitschrift für Augenheilkunde, Bd. I. (1899), S. 360.

Pricking the coverings of the follicles before expression will not suffice to prevent these evil consequences.[1]

In this early stage the galvano-cautery is more to be recommended. It is also specially adapted for removing follicles which have escaped expression, or for supplementing other methods, such as surgical interference.

Whilst expression in its various forms is to be regarded as an admirable method, which can be applied with ease and is suitable for out-patient treatment, leading in suitable cases to rapid cure, it unfortunately gives no guarantee against re-infection.

The older authors, Philipp von Walther, Rust, Eble, and others, early noted the predilection of Trachoma for the fornices, and it has more recently been generally recognised that it is here that refractory exacerbations and recurrences take their origin. The greater development here of conjunctival tissue, and of its folds and furrows, its relative immobility during movements of the lid, and its partial escape from the force of the stream of tears, tend to facilitate the adhesion and implantation of the microbes of Trachoma, and predispose these parts to the disease.[2] Since the fornices more or less escape treatment during expression, it is not surprising that re-infection is very common and indeed almost the rule after the return of patients to their infected families.

This experience has led to the extensive use of excision in German Trachoma provinces, especially in East Prussia, often with brilliant results.

After Galezowski[3] had already in 1874 warmly recommended excision of the fornices—*i.e.* the so-called "simple excision"—Heisrath,[4] of Königsberg, a pupil of Jacobson's, in 1882 introduced the simultaneous excision of the fornices and of a part of the tarsus. This procedure heralded an

[1] *Raehlmann*, loc. cit. S. 33.

[2] *Kuhnt*, Ueber den Heilwert der mechanischen Methoden in der Therapie der Conjunctivitis granulosa 1899, S. 16.

[3] *Galezowski*, Recueil d'Ophthalmologie 1874.

[4] *Heisrath*, Berl. klin. Wochenschrift 1882, No. 28-30.

unlooked-for advance in the treatment of Trachoma, and has proved of invaluable service, particularly in the struggle with the disease in endemic areas.

Heisrath's methods of operation were extended and improved chiefly by Vossius [1] and Kuhnt,[2] to whom the reader is referred for details of technique. Simple excision, which was also much employed by Schneller, of Dantzic,[3] is indicated in Trachoma confined to the fornices: (1) when other methods have proved futile, or on recurrence; (2) when the tarsus or bulbar conjunctiva is invaded; (3) in corneal complications; (4) in all individuals who come from a trachomatous horde and have to return to it again.

The much more important conjunctivo-tarsal excision or combined excision is indicated [4]: (1) in all chronic forms in which, besides the characteristic conjunctival infiltration and development of follicles in the fornices and lids, there is also infiltration and thickening of the tarsus, whether the cornea is involved or not; (2) in extensive chronic Trachoma of the fornices and conjunctiva tarsi, independently of actual changes in the tarsus, if the cornea is already involved or threatens to become so; (3) in gelatinous Trachoma, even when confined to the fornices, if the convex edge of the tarsus shows the typical thickening; (4) even in cured Trachoma of the fornices, if the palpebral conjunctiva and tarsus are gelatinous or threaten to become so. The treatment is contra-indicated: (1) in early cases without corneal complications; (2) if scarring has commenced; (3) if there is evidence of any marked tendency to shrinking (threatening xerosis).

In no casemust any of the conjunctiva bulbi be excised, so that the globe must always be covered with conjunctiva, even on the most extreme rotation downwards. Sharp limitation of the process on the bulbar side is

[1] *Vossius*, loc. cit. S. 336.
[2] *Kuhnt*, Ueber die Therapie, etc. S. 112-53.
[3] *Schneller*, von Graefe's Archiv f. Ophthalm. Bd. XXX. 4, S. 131.
[4] *Kuhnt*, Ueber die Therapie, etc. S. 131.

therefore essential for rapid and complete success in both simple and combined excision.

When the bulbar conjunctiva is involved, this must first be cured by expression and treatment with drugs, after which the question of completing the cure by a moderate excision of the fornices or paring the tarsus will arise.

Kuhnt, who was formerly an opponent of excision,[1] had "to listen to necessity," owing to the failure of all the other methods in treating Trachoma in East Prussia. He agrees that Heisrath's combined excision, when rightly applied, especially in very severe cases, works wonders. The author, from practical experience for eight years in a trachomatous region, can fully confirm this favourable estimate, which is indeed held by all practitioners who depend upon their own observations. We cannot here enter into the objections, for the most part purely theoretical, of the numerous opponents of excision; they have long been refuted by those who have tried the method.

The copious flow of blood which accompanies the operation relieves the tissues as a whole. The chief seat of the mischief, the fornices, is dealt with at one stroke, and in this manner it is possible to avoid any secondary thickening of the tarsus leading in time to a chronic trouble which will outlast the actual disease and prevent its reaching a definite conclusion. Jacobson, senior, of Königsberg, a man of extraordinary experience of Trachoma, who has treated the disease more than any one else by medicaments, became eventually an ardent supporter of Heisrath's excision. In his classical *Beiträge zur Pathologie des Auges*[2] he asks experts to convince themselves by personal observation of the certain action of the method, by which "fewer weeks suffice to cure bad cases than was requisite in as many years by the old methods—more or less interrupted use of lotions —to leave them blind or unfit for work."

[1] *Kuhnt*, loc. cit. S. 120 u. 131.
[2] *Jacobson*, Beiträge zur Pathologie des Auges. 1888.

Excision must, however, be carried out by an experienced and skilful operator, if irreparable complications are to be avoided. This is to be particularly insisted upon, since much harm is done by excessive and uncalled-for excision, so that the method is thereby discredited. Kuhnt,[1] like Heisrath, sums up the advantages of excision thus: the time required for bringing about a cure is extraordinarily reduced, lasting on an average only six weeks, including after-treatment: secondary, corneal complications are prevented or cured; entropion and ptosis are prevented or compensated; inflammatory sequelæ, exacerbations, and reinfections are in most cases avoided. Expression permanently cures, at the highest estimate, only 10 per cent. of cases; excision, 50 to 60 per cent.; whilst Hoppe[2] admits only 34·3 per cent.

For cases of Trachoma in the stage of scarring, with healed conjunctiva, but still intensely infiltrated and thickened tarsus, leading generally to obstinate pannus, Kuhnt has introduced a very valuable method—(isolated) excision of the tarsus.[3] It is also useful in the second stage and in gelatinous Trachoma, and also when the conjunctiva bulbi is affected, the conjunctiva tarsi having healed and the tarsus alone being still diseased.

This short review of the chief methods of treating Trachoma has shown us that there is no universal method, and that there cannot be one on account of the protean manifestations of the disease. The leading maxim must be a careful and conscientious individualisation.

The confusion which still prevails as to treatment depends in the first place upon the failure to distinguish between the harmless follicular catarrh and the refractory Trachoma. Further, the very different curability of the disease in immune and infected districts is not sufficiently

[1] *Kuhnt*, loc. cit. S. 135.
[2] *Hoppe*, Klin. Monatsblätter für Augenheilkunde 1898, S. 3.
[3] *Kuhnt*, loc. cit. S. 146.

recognised,[1] and is often estimated in an iron-bound and theoretical manner.

Hence it is to be remarked that effectual treatment of Trachoma demands great experience, acute observation, and elaborate technique. The author, from prolonged sojourn in a trachomatous area and on the ground of his own experience, is not inclined warmly to advocate expression, etc., to less practised operators. It will work wonders in many cases, but will often fail in severe, complicated, and obstinate cases. These are the suitable cases for excision, which cannot be replaced by any other method. The author recommends every practitioner who has to do with Trachoma to use a special set of Trachoma instruments, such as have been devised by Kuhnt and by Greeff, more particularly on account of the infectiousness of the complaint.

For the rest, the treatment must be accurately suited to the stage and special form of the disease, with occasional recourse to such methods as the galvano-cautery, the spoon, massage, etc., paying careful attention to the whole of the factors, external and individual, of the given case.

In children, in whom Trachoma is more easily cured, radical methods, such as excision, are contra-indicated, and expression combined with subsequent treatment with drugs should be used.

The dwelling-place of the patient and the climatic and telluric factors in the question of re-infection, as well as personal, domestic, and hygienic conditions, must be considered. All methods which entail the retention of the fornices, however good the results in immune districts, run the risk of facilitating relapse or re-infection in trachomatous districts.

The general bodily health must always be considered, especially any dyscrasia, such as scrofula, anæmia, etc., as these impede healing and favour corneal complications.

Before all things, in every case, it is necessary to

[1] *Kuhnt*, loc. cit. S. 23.

determine whether a so-called dry or a secreting type of the complaint is present; the rapid cure of any discharge must be striven after on prophylactic grounds. The surgeon must investigate the stage of the disease, whether the process is a superficial or deep one, and its extent. Trachoma of the fornices naturally requires different treatment from disease of the tarsal conjunctiva. The involvement of the bulbar conjunctiva makes the prognosis worse.

Whatever method is adopted, the whole of the diseased area must be attacked, the conjunctiva being examined afterwards with a loup if necessary, so as to avoid leaving any follicles.

If the limbus is much swollen, or the edge of the cornea vascularised and infiltrated, corneal complications are to be feared. All irritating treatment must then be abandoned, and the case treated like one of keratitis.

No less is tarsal complication a prime object of attack. Blepharospasm and blepharophimosis demand a canthoplastic operation; any blepharitis must be treated, the condition of the lacrymal passages must be investigated in every case. Dacryocystitis in Trachoma usually requires extirpation of the lacrymal sac.[1]

In trichiasis, the commonest cause of blindness after Trachoma, when the lashes are diseased, the lid margin must be excised and the mucous membrane brought forward (van Millingen). Entropion and ptosis are often permanently cured by appropriate excision of the tarsus.

In obstinate pannus one may use massage, spraying, and irrigation, subconjunctival injections of saline solution or sublimate, peritomy, slitting up of the individual vessels,[2] or the galvano-cautery. In desperate cases, otherwise not inflamed, de Wecker's jequirity treatment, or better jequiritol (Römer-Merck), is very successful; in suitable cases tattooing and optical iridectomy are indicated.

[1] *Axenfeld*, loc. cit. S. 27.

[2] *Schmidt-Rimpler*, Einige Bemerkungen über Trachom, etc. 1898, S. 7.

In xeropthalmia Rudin's operation for narrowing the palpebral aperture by sewing up the lids is useful. Unfortunately the good effect is often spoilt by the patient having the lids again opened for the sake of appearance.

We have seen that the treatment of Trachoma has made considerable progress in the last few years, so that the general attack on the disease has advanced much, as the following chapter will show.

The cure of Trachoma depends upon the earliest possible treatment of the disease, aiming at thorough but sparing removal of the trachomatous infiltration by chemical, thermic, mechanical, or surgical means in various combinations before the commencement of scarring, as well as by hygienic and general treatment; thus is the process cut short, and the dire sequelæ are prevented. It is unnecessary after all that has been said to emphasise further the importance of detailed hygienic and prophylactic measures,[1] prolonged watching, and where possible change of dwelling into an immune neighbourhood. Unfortunately the best of rules and advice are often futile in dealing with indolent, ignorant, and bigoted patients, who are under the ban of wretched domestic conditions.

[1] Such rules are collected in *Cohn*, Lehrbuch der Hygiene des Auges 1892, S. 153, und *Greeff*, loc. cit. S. 70 ff.

CHAPTER VIII

PROPHYLAXIS

None of the literary records which have come down to us from ancient times or from the Middle Ages give any account of the prevention of Trachoma. As has been shown in Chapter IV., it was known 2,000 years ago that "ophthalmia" is a contagious disease, and epidemic and endemic inflammation of the eyes were also not unknown.[1] Hippocrates, in his work on climatology (περὶ ἀέρων . . .), which has unfortunately come down to us only in fragmentary form, endeavoured to trace the type of inflammation to the locality, season, and weather.

Among the Arabs, 1,500 years later, we nowhere find any notion of an endemic disease, though they had plenty of experience of endemic Trachoma in Hither Asia and North Africa. They were accustomed to regard the disease as a special dispensation of Providence.

It is in the Napoleonic period that we first find a copious literature on Trachoma, the question of prophylaxis and public supervision being thoroughly discussed. Larrey[2] recommended as an essential preventive for the French army in Egypt that they should never, when bivouacking after the glaring heat of the day, expose themselves to the damp nights without hoods or coverings. This regulation could only be carried out by the sternest discipline, for the soldiers could not then enjoy the cool evening air. Larrey

[1] *Hirschberg*, Handbuch der gesamten Augenheilkunde von Graefe-Saemisch, Bd. XII. S. 72.

[2] *Peltzer*, Die Ophthalmia militaris 1870, S. 75.

also gave orders to avoid bivouacking near damp, marshy places, and to shade the eyes in the daytime from the glare of the sun, if necessary with a bandage. Buonoparte used in Egypt water acidulated with lemon juice as a preservative against Trachoma, and afterwards white precipitate ointment was recommended to be smeared along the edges of the lids for the same object.[1] Baltz,[2] who asserted that Trachoma was of autochthonous origin, arising from the extrinsic conditions of the military life, gave advice which was difficult to carry out—viz. to avoid those conditions, and particularly those due to overcrowding, etc. Further, all excessive physical exertion should be avoided in a dry heat, recruits should not be enrolled in the autumn, and should not wear their hair too closely cropped or their collars too tight. He also laid stress upon preventing direct transmission of the "material"—*i.e.* the conjunctival secretion—by due attention to cleanliness. The clothes of trachomatous patients, when discharged from hospital, were to be cleaned with lye, and the men were to live in as pure an atmosphere as possible and at an equable temperature.

In 1818 and 1819 Rust gave expression to his views on the extreme contagiousness of Trachoma in his *Rules for the Disinfection of Troops, their Kits and Quarters*, which he drew up for the garrison at Mainz.[3] Barracks were erected outside Mainz for the reception of the disinfected soldiers, and the absolutely necessary utensils were conveyed from the old quarters to the new only after preliminary fumigation with sulphur or chlorine in special "fumigating chambers," and washing with lye. The soldiers who had remained free from the disease had to wash themselves with special sponges, first with a solution of caustic potash and then with water; after receiving

[1] *Peltzer*, loc. cit. S. 89.

[2] *Baltz*, loc. cit. S. 291 f.

[3] *Rust*, Die ägyptische Augenentzündung unter der Königl. Preuss. Besatzung in Mainz 1820, S. 31 ff. u. 255.

their clothes, previously disinfected or quite new, they had to pass through a special door straight into the barracks. The effects that were left behind were disinfected and then conveyed to the new quarters. Articles which could not be disinfected were burned. The old barracks were then thoroughly fumigated, scrubbed, whitewashed, and ventilated. The part of the building first disinfected was then used as a complete quarantine hospital, the next was employed for the reception of the first batch of soldiers coming into the hospital, and so on. Guard-rooms, prisons, sentry-boxes, and clothing stores were treated in a similar manner.

When all the healthy soldiers had been disinfected, the eye patients themselves and the hospital patients were put through a similar treatment. Rust separated the eye patients according to the stages of the disease, and drew up a special *Order for the Treatment of Patients from the Point of View of Service and Discipline.*[1]

After the epidemic, in which no fewer than 1,798 men were affected, between June, 1818, and September, 1819, had been stamped out, the whole garrison was drafted in battalions into different places, so as to remove all traces of any predisposition to fresh disease. Rust was very strongly opposed to drafting infected soldiers into neighbouring villages.

This line of treatment was found to work very well; while Jüngken's proposal to discharge all the trachomatous soldiers to their homes at the time of the great epidemic in the Belgian army certainly eliminated it at one sweep, but in return flooded the whole country with the disease. The three sets of instructions[2] which he caused to be given to each patient on his discharge were not sufficient to ward off this disastrous result. The first set was to inform the relatives of the contagiousness of the complaint and the

[1] *Rust*, loc. cit. S. 278.

[2] *Jüngken*, Ueber die Augenkrankheit, welche in der belgischen Armee herrscht 1834, S. 38 f.

means of avoiding infection; the second laid down the diet and other directions for the patient himself; the third was to the burgomaster of the place, to keep the discharged men under supervision. In thus recommending the discharge of all Trachoma patients, Jüngken was swayed by the common experience that such patients often show surprisingly quick improvement at home, while in hospital they frequently require treatment for months or years. He did not know[1] that in Belgium there are no Government surgeons like the district surgeons in Prussia, who would have to undertake the supervision of the men.

Eble[2] rightly laid most stress on rejecting trachomatous recruits; he also recommended frequent periodic examination of the troops, as Jüngken had done.

Löffler[3] went decidedly too far in urging that all who were suffering from so-called primary granulations should be rejected as recruits. He understood by "primary granulations" what is to-day known as harmless follicular swelling (Folliculose), and regarded it as the first stage of Trachoma.

In the Prussian army the terrible ravages which Trachoma made early led to the adoption of regulations for the arrest and prevention of the disease. An order from the War Office was issued on July 19th, 1821, in the following terms:—[4]

"If the palpebral conjunctiva in cases of contagious ophthalmia has not recovered its normal condition after several months' treatment in hospitals and observation wards, and if chronic congestion, œdema, and granulation of the conjunctiva remain, such soldiers are to be discharged to their homes. If this congestion and œdema are accompanied by unhealthy discharge, pain, and tenderness of the globe, or other symptoms, they must not be discharged until these symptoms have disappeared. Before discharge these soldiers must have a warm bath, and their

[1] *Prager*, loc. cit. S. 318.
[2] *Eble*, loc. cit. S. 247.
[3] *Löffler*, loc. cit. S. 303 und 313.
[4] *Löffler*, loc. cit. S. 314 f.

clothes are to be disinfected by washing or fumigation, according to the texture of the material."

The regulations of August 8th, 1835, which are still in force, contain very stringent measures. In sect. 62 it is enacted that soldiers suffering from contagious ophthalmia are to be isolated and treated in special wards of the hospitals; but if after seven months' treatment there is no improvement, they are to be discharged and placed under the pension officers, provided they can obtain a medical certificate that there is no longer any fear of contagion.

"Moreover, the greatest care is to be taken that they are themselves thoroughly disinfected, and they are to be provided with perfectly clean clothes.

"At the same time, a list of the names of patients to be discharged, together with their residences, are to be sent to their respective councils. These councils are to report to the district medical officers, and to give notice to them, as well as to the burgomasters and especially the surgeons practising in the same neighbourhood, to keep a sharp look-out upon them.

"Public instruction is also to be given as to the preventive measures necessary to be taken.

"If such patients have a relapse, they are to be transferred at once to the nearest military hospital if such relapse occur within a year from the time of discharge, otherwise they are to be treated by the civil authorities."

With regard to civilians who become infected and public institutions, it is laid down in sect. 63 as follows:—

"In the case of civilians having Trachoma, the general regulations of the Board of Health for the less dangerous infectious diseases come into effect (sect. 18c, according to which patients are bound only to keep aloof from intimate contact with others, and particularly not to visit public places).

"Special attention is to be given to public institutions where large numbers of people live together. If the

disease breaks out here, partial or complete evacuation of the institution may be necessary."

Sect. 64 treats of the disinfection of effects and dwellings.

By a supplementary order from the Minister of Public Instruction,[1] dated November 11th, 1862, the local police authorities are to find out persons suffering from suspected acute ophthalmia, to take steps for their treatment by a doctor or in a hospital, and to determine and remove the source of the disease. The councils are to issue brief instructions as to the signs, spread, and prevention of granular conjunctivitis.

It was also enacted that the council be informed of any cases of Trachoma discovered in the pension department (*Ersatzgeschäft*)—first by an order dated April 8th, 1877, sects. 3, 9, and again on February 1st, 1894, sects. 3, 8.[2]

Formerly only severe cases of Trachoma were rejected in recruiting for the Prussian army, the milder cases being admitted.[3] The continued differences in the opinions held by the inspecting surgeons on essential points led to the formulation of Jacobson's regulations in 1880, and in 1893 to the improved regulations of von Hippel "for the examination and diagnosis of recruits," according to which they are now rejected if they have Trachoma, as understood in the dualistic sense.

Objections have recently been raised to this code by various competent authorities—*e.g.* Heisrath,[4] Kuhnt,[5] Greeff,[6] Hoor,[7] Nenadovic,[4] who maintain that trachomatous recruits should be admitted into the service if they offer reasonable prospect of being cured. This claim is put forward principally in the interests of the general prophylaxis

[1] Regulativ vom 8. 8. 1835, S. 18 f.
[2] *Kirchner, M.*, Grundriss der Militär-Gesundheitspflege, S. 450.
[3] *Kob*, loc. cit. S. 24.
[4] Comptes-rendus du XII. Congrès international, Vol. VI. S. 136 und 106.
[5] *Kuhnt*, loc. cit. S. 169.
[6] Münch. med. Wochenschr. 1898, S. 643.
[7] *Hoor*, loc. cit. S. 57.

of Trachoma; for it is urged that by drafting in these men and ultimately completely curing them, a great source of infection would be removed, and a most effectual check put upon deliberate attempts to set up purulent ophthalmia at recruiting time by the use of irritants, etc.

However useful and enticing this plan may seem at first sight from the public health point of view and that of increasing the fighting strength of the nation, the author is unable, after full consideration, to support it. The evil results which have accrued from enrolling trachomatous recruits in Russia are a warning to others not to repeat the experiment. Lawrentjew,[1] the oculist of the military district of Moscow, stated, at the congress held in that city in 1897, that Central Russia, which had previously been entirely free from Trachoma, had in the course of years become seriously infected owing to the enlistment of trachomatous recruits from infected areas in the west; and all Russian authors have for years been urging that men with Trachoma should be rigorously excluded.

On the other hand, the author is of the opinion that the good results which have been obtained in the Prussian army by rejecting men with Trachoma, and the steady decline in the frequency of the disease, are weighty arguments in favour of making no change in the regulations, especially as in other countries, such as France, Italy, Belgium, and Great Britain, the same good results have been attained. The fact that there is still so much Trachoma in the Austrian army is greatly due to the large numbers of trachomatous recruits that are admitted year after year, in spite of the regulations against it.

Although it must be admitted that great progress has been made in the treatment of Trachoma during the last twenty years, military life is, as we have seen, attended by a host of unfavourable circumstances, which on the one hand make the cure of the patients more difficult and give rise to frequent relapses, and on the other help greatly

[1] *Lawrentjew*, Comptes-rendus, etc., S. 121.

to spread the disease. A vicious circle is too readily set up which it is very difficult to break.

Moreover, a large number of Trachoma patients in any corps would be a heavy burden. Except in rare cases such soldiers are useless, since great care has to be taken of them, they have to be exempted from many duties, such as stable work, guard, and orderly duty, and are readily incapacitated for work in inclement weather or at fatiguing exercises. They require constant supervision, and are very difficult to cure, especially, as sometimes happens, when they have no desire to be cured. In time of war they constitute not only a heavy burden, but a very serious danger, because it is impossible to carry out proper treatment. It is more difficult to prevent the spread of the disease during war than in time of peace, and the pensions of invalided trachomatous soldiers, the number of whom would then increase, would be a grievous tax on the finances of the State. It cannot, therefore, be thought that the admission of trachomatous recruits is an indispensable measure in the general crusade against Trachoma: the State will attain this end on the old lines. Moreover, the civil authorities will, according to the regulations, have to see to the necessary medical treatment of those who have been rejected on account of "Gr. II." Nevertheless, the author is of the opinion that the inspection of recruits in Trachoma districts might be made with much greater care and thoroughness. Inspectors should, one and all, be so trained by a course of teaching that it would no longer be possible to find so many cases of simple follicular conjunctivitis or even of artificial conjunctivitis recorded as Gr. II. If they had more practice, and took more care in diagnosing, there is no doubt that the loss of recruits from Trachoma might be considerably diminished. Doubtful or suspicious cases might be submitted to special inquiry, or accepted with a view to investigation.

Experience has shown that it is impossible to keep out all sufferers from Trachoma. Apart from the few

non-inflammatory and latent cases which are overlooked, it is impossible, especially in trachomatous districts, to prevent the infection of the soldiers by civilians, in their quarters, or on furlough, or at manœuvres. Such men are, according to the regulations, discharged as unfit for service only when permanent and incurable changes have supervened. On the other hand, being as a rule fresh cases, they make good subjects for the more modern medicinal, mechanical, and surgical methods of treatment, combined as necessary according to the indications given in the last chapter. It is to be hoped that the provisional discharge, allowed under sect. 36, 4, of the regulations of February 1st, 1894, of those trachomatous patients in whom complete recovery of the conjunctiva is retarded after the infectious stage is past, will become more and more rare.

It is very important to have a good code of rules for the prevention of Trachoma, particularly in trachomatous districts. Typical regulations for such areas are to be found in those which have long been followed with great success in the First Army Corps in East Prussia. Certain regulations apply to the whole army—viz. at the time, generally every month, of the regular inspection of the health of the troops, attention is to be paid to the presence of eye disease; those with infectious diseases of the eyes are to be placed in special wards in the hospital, or if for special reasons they remain in the barracks, they are to be provided with a washing-basin and a second towel to be used for their faces only.[1] Besides these the following rules are in vogue: Under the order of the Commander-in-Chief, dated March 25th, 1897, the recruits are examined a second time for Trachoma shortly after joining,[2] and the number and names are carefully noted; slight changes in the conjunctiva are also attended to and recorded. The Board of Health receives reports of the result of this examination. In Königsberg an additional inspection of

[1] Friedens-Sanitäts-Ordnung vom 16. 5. 1891, § 25, 2, S. 38 und § 152, 3, S. 171.
[2] *Kob*, loc. cit. S. 28.

all the garrison is made every year in October by the chief medical officer of the eye department. On this occasion each case of Trachoma is again thoroughly gone into with a view of determining whether the patient is likely to be able to return to duty within a reasonable time. The slight cases with no discharge remain with the troops. All fresh cases with discharge are treated in hospital until they are cured, or at least until all danger of infection is past. The moderately bad cases, if there is any doubt as to cure, are removed from the jurisdiction of the corps, and transferred to the garrison hospital at Königsberg for special treatment. Those who show very serious sequelæ are, according to sect. 36, 4, of the order, at once handed over to the pension department; or if they are incurable they are discharged as unfit for service. These men then come under the supervision of the civil authorities.

Now, the treatment of slight cases of Trachoma without discharge, which remain with the troops and require continuous medical supervision, is a subject of special importance. These constitute the so-called *Augenkontroll-kranken*, and, according to A. Roth,[1] they form 20 per thousand of the fighting strength of the First Army Corps. This number includes, besides mild, quiet Trachoma, the simplest and most trivial forms of conjunctivitis, because experience shows that these slight cases of conjunctivitis are predisposed to the infection of Trachoma.

Special lists are made of these *Kontroll* patients in every division by the divisional surgeons, and inspections of the eyes are made with greater or less frequency, according to their number.[2] The chief surgeons do this as a rule once a week. In Königsberg these patients from the entire garrison are seen every week by the surgeon of the eye department. Moreover, the divisions are directed to bring

[1] *Roth, A.*, loc. cit. S. 200.

[2] Sanitätsbericht für die Preussische Armee für 1886-97, S. 111, für 1894-6, S. 142 und für 1889-90, S. 152.

subjects of eye congestion or discharge at once to the surgeons for examination. In this manner, whenever any of these patients show any discharge from the eyes, it is at once noted and they are removed to the hospital. By keeping a register with notes of the progress of the cases, newly appointed surgeons are provided with a continuous history.

In order to prevent the infection from spreading among the healthy troops, great care is taken that all the men, including the healthy ones, use only their own washing-basins and towels. Further, the names of the *Kontroll* patients are painted on their basins, and their towels are prominently marked. The precaution of making these patients use their own washing-utensils is strictly carried out in the guard-rooms, etc., and during the stay of the troops outside the garrison, especially during manœuvres.

Efforts are made to keep the *Kontroll* patients apart from the healthy soldiers, the former being accommodated in separate apartments, which are conveniently situated at the end of the regimental quarters, or at places where they will least come in contact with one another. In these apartments the barrack regulations as to ventilation, cleanliness, and the removal of dust with damp cloths, are maintained and carried out with scrupulous care. Special attention is given to the cleaning of door handles, etc.

The patients' eyes are wiped out regularly three times a day, especially after a dusty march, stable work, etc., with pledgets of wool dipped in a mild astringent or disinfectant lotion. The men are also exempted from dusty house-work.

The healthy soldiers as well as the patients frequently receive instruction on the dangers of infection. Printed notices with easy instructions on the prevention and treatment of Trachoma are hung on the walls of barracks and hospitals.

Every fresh case of Trachoma is at once reported by the

divisional surgeon direct to the Board of Health, with an account of the source of infection, so far as it can be ascertained or suspected, and the measures taken to remove it.

The fresh cases are immediately sent first into the hospital in the garrison town for treatment, no time being lost in transferring them for special treatment, if necessary.

The Board of Health provides for the proper instruction of all their officials in the diagnosis, prevention, and treatment of Trachoma. Every surgeon beginning his duties with these patients has to go before the chief ophthalmic surgeon for special training and the receipt of instructions.

The chief divisional surgeons are responsible for the suppression of Trachoma, and they dare not hand over this duty to assistant surgeons. In fine, the commander-in-chief bids the principal army surgeons look to the medical officers of the health department for energetic support.

By carrying out these comparatively simple rules, which have come more or less into force over the whole army, the amount of Trachoma in the army has, as we have seen, been more and more reduced. This is particularly the case in the First Army Corps, in which the average of infectious diseases in 1867 amounted to 32·3 per thousand, and between 1881 to 1885 to 18·2, when it gradually sank from 1886 to 1890 to 9·7, from 1891 to 1895 to 5·8, and in 1899–1900 to 2 per thousand.[1]

Heisrath, to whose tireless energy these splendid results are largely due, lays stress, in the report from which we have just quoted, on the fact that it is of the first importance to give speedy and continuous help to the bad cases, thus cutting short the disease and preventing relapses, a result which it is possible to attain with modern methods of treatment. Long sojourn in the hospitals is inadvisable, probably because of the abundance of germs present there. Search must be made in the regiments for men suffering from the complaint; it is of no use waiting for them to

[1] Sanitätsbericht 1899—1900, S. 112.

report themselves. The organisation of the *Augenkontroll-kranken* has worked excellently. Bad cases of Trachoma have become rare in the army. With constant medical supervision, plenty of fresh air, and hard work, many simple cases of Trachoma are cured without any special treatment or cessation of duty. Numerous trachomatous men, some of them bad cases, have been drafted into the army without injury to the healthy soldiers, and discharged perfectly cured at the expiration of their time of service.

It is indeed rare to find a case of Trachoma stated in the army medical reports as being due to infection from within the regiment. Nevertheless, the author doubts if the results would be so good if the drafting of trachomatous men were carried out as a general principle.

It is difficult to add anything to the preventive measures just described, for this code of rules now in force in the Prussian army is generally recognised as being typical and comprehensive.

It is scarcely necessary to mention that there is a risk of the inspecting surgeon conveying contagion with his fingers in the numerous examinations which he has to make. The disinfection of the finger-tips is therefore particularly important as a preventive. This is best done with a pledget of cottonwool soaked in sublimate solution, a method in use in the eye clinic at Königsberg.[1] According to Kob,[2] special prison cells had to be provided for trachomatous soldiers in a seriously infected garrison.

There is no occasion to go into details as to the preventive measures recommended in other armies, especially those of Russia and Austria. We may refer the reader to the works of Feuer, Hoor, and Ebert. In the Russian army special tactical units were instituted for trachomatous soldiers, and special Trachoma stations were set apart in the Caucasus as hospitals.

Feuer recommends the erection of so-called Trachoma barracks for the reception, treatment, and military training

[1] *Kob*, loc. cit. S. 32. [2] *Kob*, loc. cit. S. 32.

of trachomatous soldiers who cannot be admitted into the Austrian army. Hoor [1] advises enrolling all trachomatous men who show promise of possible cure; they should be treated in a military hospital, and not allowed any leave of absence. He desires to see thoroughly trained ophthalmic surgeons in the army, who would have to deliver a course of lectures on Trachoma, extending over at least three weeks, so as to obtain surgeons with some experience of the disease.

Ebert [2] also advocates as a matter of the first importance that the army surgeons should receive the best possible training in the diagnosis and treatment of Trachoma. He suggests as one of the reasons for the great spread of the disease among the Austrian troops the drinking-tubs, in which the water is generally stale and warm, and which are often used by the men to wash their faces in, especially in the winter time.

Special attention must be given to the rules for the prevention of Trachoma during manœuvres in an infected district. In the first place, the common use of washing-utensils, beds, etc., must be prohibited, and intercourse between the troops and infected civilians restricted as far as possible. Soldiers are not allowed to be quartered in places where the disease is endemic.

When war is being waged in an infected country, the scrupulous use of all the preventive measures at our disposal cannot always avert the outbreak of an epidemic, as is shown by the English expedition in Egypt (1881-5) and the Italian expedition in Abyssinia (1897). It is always necessary to bear this risk in mind under such circumstances. An outbreak may easily assume large dimensions, as it is difficult to separate infected persons effectually, and the common use of washing-utensils, beds, straw, etc., is almost the rule. Moreover, the eyes are rendered particularly susceptible by various injurious influences, such as night watches, dust, smoke, and ill-ventilated

[1] *Hoor*, loc. cit. S. 75.

[2] *Ebert*, loc. cit. S. 29 und 35.

rooms, and the whole body has its powers of resistance lessened by hardship and privation.

During the Egyptian campaign of 1881-5[1] the English endeavoured to check the spread of the disease by separating the infected troops as far as possible in open tents (each man being provided with his own washing-utensils), by the use of eye-shades, veils, and goggles, the daily examination of all the troops, and the immediate isolation of infected soldiers. Native dwellings were avoided as much as possible, being used as quarters only when they had been disinfected. The rise of dust in the camp was prevented as far as possible by watering the ground and leaving uncut the grass and bushes to the windward side. In the epidemic which broke out, principally after the troops had been quartered in the infected and abandoned barracks in Cairo, where the men were not supplied with separate washing-utensils, no fewer than 1,783 soldiers suffered from Trachoma up to 1883, though the disease, thanks to the hygienic measures employed, ran a comparatively mild course.

It is specially important from the prophylactic standpoint to prohibit strictly the drafting of trachomatous soldiers to the front along with other troops. In this connection reserves drawn from infected districts must be especially watched. It is a fundamental axiom that trachomatous soldiers are useless at the seat of war, nay, are even a source of danger, and at most should be employed on garrison duty with the reserves under proper regulations.

Infected regiments can at the best only take up a position in the field on the flanks, at a considerable distance from the main force. If the conditions are very unfavourable, the question of disbanding these regiments may have to be considered.

There is a Health Regulation for active service[2] to this effect: "If eye diseases break out among the troops to an

[1] *Niedner*, loc. cit. S. 168.

[2] Kriegs-Sanitäts-Ordnung vom 10. Januar 1878, Anl. § 47.

alarming extent, the question must be considered whether the non-infected troops should not be removed or separated from the infected in order to check further spread of the disease. The healthy troops must be examined for eye affections more frequently than usual. Those who show traces of granulations or slight catarrh must not be too hastily removed to the hospitals. If there are widespread epidemics of eye disease at the seat of war, it may be necessary to stop removing these patients to the reserve hospitals altogether for the time being." Considering the not infrequent outbreaks of slight follicular catarrh or acute infectious (bacillary) conjunctivitis, this last regulation is very wise. If an epidemic of Trachoma broke out at the seat of war where there was no satisfactory accommodation, the author would consider it imperative to treat the milder cases in tents or portable barracks, such as are, indeed, ordered for use in the treatment of epidemics on active service. Bad cases would have to be put under the proper regulations of the reserve hospitals.

It is very unlikely that in the future, with the excellent hygienic arrangements for active service, we could be overtaken by an epidemic of Trachoma.

The evident success which has attended the preventive treatment of Trachoma in the army, especially in Germany, naturally shows itself indirectly among the civil population. The military authorities are able to give a complete account of all the cases of Trachoma among males who are liable to serve in the army; and they will be able to do this the more accurately the more the existing difficulties of diagnosis are reduced. By thus knowing the number of cases among the males of this age, they can at once tell where the disease is endemic. Their methods are, therefore, well suited to discover any outbreak at its commencement, allowing the necessary preventive measures to be taken in good time. Since the civil authorities receive notice of all the cases of Trachoma which are discovered at the

military inspection, a great advance is made in the prophylaxis of the disease.

It is a specially important prophylactic ordinance that all soldiers who have been discharged for Trachoma after the infectious stage is past, straightway come under the supervision of the civil authorities.

Thus the German army system, with its universal conscription, provides a very important means of discovering and preventing Trachoma, even though it must be admitted that it is not perfect. A good and rational code of preventive measures must be drawn up and carried out side by side with that adopted by the army before permanent success can be achieved. Trachoma finds a most dangerous hiding-place among the civil population, and particularly among the poorer agricultural classes in the less civilised districts; here it is difficult to discover and still more difficult to combat. It gains a footing unnoticed, and multiplies and spreads to an alarming extent, as it has done from time immemorial, and especially since the Napoleonic wars.

As regards the prevention of Trachoma among the civil population, much of what has been said on the army applies with equal force, though the conditions are different. In the first place, all the instructions laid down for the individual soldier are applicable to the civilian. It is specially important to carry out these rules in infected districts.

The patients and those who come in contact with them must be instructed as to the infectious and dangerous character of the disease, and the fact that every eye disease with discharge is infectious. Since it is an established fact that Trachoma is for the most part conveyed by the common use of infected towels, etc., it must be a first principle that every one be forbidden to use such utensils, and that they carefully guard against coming into contact with the infectious discharge in any manner, directly or indirectly. Besides general cleanliness, the people must

keep their hands and eyes scrupulously clean, and abstain from all unnecessary rubbing of their eyes with their fingers. Since, too, there is strong evidence that the virus may cling to various objects—the floors, walls, doors, and dust of rooms—great importance should be attached to the cleanliness of the houses and all their belongings. Experience teaches that cleanliness is the best safeguard against Trachoma as against many other diseases. The author would not go so far as to recommend persons living among infected ones to use disinfectant eye lotions, such as weak sublimate or boric acid. It is only under specially bad conditions that such a prophylactic measure might be considered; generally speaking, it is superfluous.

Any one who should be unfortunate enough to become infected should know that his salvation lies above all in early treatment, that it is an easy matter to check the disease in its early stages, but difficult, and frequently impossible, to achieve a perfect cure in old-standing Trachoma or its sequelæ. The patients should have their own utensils set apart, and any attempt at the common use of such things should be strictly prohibited.[1] The pieces of lint or wool employed for wiping the discharge from the eyes should be burnt, while more valuable towels, etc., should be thrown into hot water or some disinfectant.

Trachoma patients must always keep their hands clean, and abstain from touching other persons and things unnecessarily. It is not usually necessary to insist on strict isolation in private houses; on the other hand, in private institutions, such as boarding-schools, lodging-houses, etc., where the inmates live together as in a family, and use the same day- and bed-rooms and utensils, this rule should be

[1] Very complete and practical instructions are found in a new code of the Grossherzogl. Mecklenburgischen Medizinal-Kommission in Rostock on Egyptian ophthalmia. Cf. *Königshöfer*, Die Prophylaxe in der Augenheilkunde in *Nobiling-Jankau*, Handbuch der Prophylaxe, S. 661; also in the Schutzmassregeln bei ansteckenden Krankheiten. Berl. 1901, S. 1 und 2, edited by the Verein der Medizinalbeamten des Regierungsbezirks Potsdam.

enforced. These patients require to be kept under medical supervision for some time after they are cured.

So much for the prophylaxis of the individual, though it will unfortunately still be long before it can be generally carried out, especially among the poorer agricultural, less cultured classes, who are most subject to the disease.

It is still more necessary that the State should adopt measures for stamping out the dangerous national scourge. The complete extermination of the disease should be aimed at, because it possesses the peculiarity of breaking out from some small unknown focus, from which in the course of years it spreads widely. Considering our present knowledge, complete extermination is by no means impracticable, and Trachoma may be characterised, like smallpox by Larrey, as a disease which is a disgrace to humanity.[1] Of course, such a result could only be attained after many years of work.

In discussing the general prophylactic measures, we may first consider the extinction of the disease in Germany, or in its most infected state, Prussia. The main problems are: (1) the prevention of the introduction of Trachoma from the neighbouring seriously infected countries; and (2) its extermination wherever it has gained a footing.

As regards the first question, we have seen that the greatest danger are the agricultural labourers from Poland, who are either drafted in large gangs under contractors or cross the frontier singly, every summer, to help in the fields, returning home in the autumn. They occupy the same apartments, usually small and bad, with the other labourers at the Prussian farms. Considering the lack of agricultural labour prevailing in Prussia, it would not be to the interest of agriculture there to send back all these foreigners. On the other hand, it is essential to keep a strict watch over them, and recently various official orders have been issued for their control. As soon as they enter the country they are submitted to a medical examination at the employer's expense, and in 1899 special attention was

[1] *Eloui*, loc. cit. S. 39.

drawn to the necessity of examining them for Trachoma. If such measures are strictly carried out, the contractors will find it to their own interest to import as few trachomatous ones as possible.

International intercourse by means of the railways[1] principally affects the better classes of society, including people entering Germany for the purpose of settling there permanently. It has no appreciable effect on Trachoma. On the other hand, the bands of Russian emigrants on their way to America are submitted to strict police supervision.

The frontier guard stations erected by the two great German shipping companies, the Hamburg-American line and the Bremen North German Lloyd, at the frontier railway stations, Bajohren (Memel), Eydtkuhnen (Stallupönen), Prostken (Lyck), and Ottlotschin (Thorn), are extremely important from the point of view of prophylaxis. They are inspected at least every three months by the district surgeons, the emigrants undergoing a searching medical examination. The companies are exceedingly careful that no diseased person gets through, since these are not allowed to land in America, and have to be taken back again at the company's expense. They are examined chiefly for smallpox, typhus and typhoid, and Trachoma. In 1900 no fewer than 330 emigrants were sent back for Trachoma from Ottlotschin alone.[2] These people suffer principally from chronic Trachoma without discharge, and they usually put themselves under treatment by some specialist at Thorn, continuing their journey when they are cured.

As many of the emigrants manage to elude these guard stations by the help of professional agents (*Schleppern*), the shipping companies have erected another station of the same kind on the railway at Ruhleben, near Spandau.

As regards the prevention of Trachoma in the interior, the spread from east westwards has been effectually checked

[1] *Hoppe*, Die Bedeutung des Trachoms in den litauisch-masurischen Grenzbezirken Russlands 1898, S. 6.

[2] Das Sanitätswesen des Preussischen Staates 1898—1900, S. 47.

by medical inspection of migrating labourers (*Sachsengänger*). This precaution is likely to be sufficient when due attention is also given to the general conditions of life and the housing of the floating population. The latter question has been taken up by the managers of some large industries and building and provident societies, though these beneficent attempts have often been crippled by the keenness for speculation which is especially noticeable in the suburbs of large towns.

It would be a very desirable thing to have the sleeping-quarters and day-rooms of the migratory workers inspected by the district surgeons as well as the people themselves, for any grievances as to quarters only become known when infectious disease breaks out.

Richter, of Marienburg, and Löschmann, of Allenstein,[1] have recommended that the right of settling in the country should be restricted; but the author considers this plan too stringent and quite unnecessary.

It is a matter of no less importance to put down the disease in the infected areas of East Prussia. Since 1895-6 a scheme of preventive measures has been instituted in imitation of the Hungarian Trachoma service, which was organised by Feuer in 1886. This has very stringent rules, but has not yet produced any appreciable results.[2] The adoption of this scheme is largely due to the influence of Kirchner, who took the matter up with great energy and success. Thus, since 1895, at first small, and then gradually larger sums of money have been put down in the estimates[3] for the prevention of Trachoma, the amount since 1898 reaching an annual total of 350,000 marks.

The main features of this Government scheme were published in 1897 by M. Kirchner.[4] Considering the

[1] *Richter*, Wie haben wir uns die Bekämpfung des Trachoms zu denken? 1898, S. 6. *Löschmann*, Deutsche med. Wochenschrift 1901, No. 50 und 51.

[2] *Nenadovic*, Comptes-rendus du XII. Congrès. Vol. VI. S. 106.

[3] Das Sanitätswesen des preuss. Staates 1898—1900, S. 131.

[4] *Kirchner, M.*, Die Bekämpfung der Körnerkrankheit (Trachom) in Preussen 1897, S. 12 ff.

peculiarity of the disease in almost imperceptibly spreading its evil influence far and wide among the lower classes, it was not thought sufficient to entrust the medical officers alone with the task of ascertaining its distribution. It was accordingly resolved to employ the greatest authorities on Trachoma, and since 1896 several leading ophthalmologists, including Förster, Hirschberg, Kuhnt, Schmidt-Rimpler, Greeff, and others, have been sent as Government commissioners to the most infected provinces. It was found from their reports that the disease had a much wider distribution than had been previously supposed.

As regards the question of laws to enforce a general crusade against Trachoma, there is still need of a universal law for police supervision in Prussia. The law passed on August 8th, 1835, may be considered antiquated, and only holds good for the older Prussian provinces. It provides, amongst other things, that no passports shall be granted to persons suffering from infectious diseases, those affected with infectious ophthalmia being prohibited from coming into close contact with other people, and especially from frequenting public places.

It was established by the decision of the Royal Supreme Court on June 27th (published in the *Proceedings*, Vol. XXXVI., pp. 6, *sqq.*), that Trachoma comes under the infectious diseases within the meaning of the Act of August 8th, 1835, and that the police authorities are not only justified in ordering, under penalty, the treatment of those suffering from it, with a view of removing risk of infection, but are even empowered to take such patients to a hospital or surgeon appointed by them, by actual force.

There is no general compulsory notification of Trachoma, although it is enforced by some councils in East Prussia. The notification, however, works so badly that it is impossible to draw up statistics of even approximate value from it.

A scheme entailing the partial notification of Trachoma, applicable to the whole of Germany, was passed by the Federal Council on July 22nd, 1902. It deals with the

notification of infectious diseases by the military and police authorities *inter se*, and, in accordance with sect. 39, sub-sect. 3 of the Infectious Diseases Act of June 30th, 1900, it ordains that "every fresh outbreak of Trachoma among the people shall be notified to the military authorities by the police," and "any epidemic of Trachoma in any military district shall be notified by the military authorities to the police." Further, they must notifiy each other when the disease has disappeared or only appears sporadically.

The new Infectious Diseases' Act, to which reference has been made, refers only to the most important diseases threatening the country from without—cholera, leprosy, typhus, yellow fever, plague, and smallpox—but contains nothing about the prevention of indigenous infectious diseases, any legislation relating to them being left to the individual State.

At the present time, however, a Bill, supplementary to the Infectious Diseases' Act of June 30th, 1900, is before the Prussian Diet.[1] According to sect. 1 of this Bill, "every case of Trachoma shall be at once notified to the proper authorities."

Mention should also be made of the Prussian Act of September 16th, 1899, referring to the duties of district surgeons and the composition of health commissions; this Act came into force on April 1st, 1901. Under it a drastic change has been made in Prussia in the duties of medical officers of health—a change likely to prove of great importance to public health. The sanitary boards under the Act of 1835 in all places of over five thousand inhabitants had for the most part become a dead letter; it is hoped that the new boards will prove much more useful, especially as the district surgeon can now call a meeting of the Board of Health at any time.

The ministerial order of May 20th, 1898, is a measure of extreme importance.[2] It deals with the question of

[1] Aerztliche Sachverständigen-Zeitung 1903, No. 5, S. 107.

[2] Dienstanweisung für die Kreisärzte vom 23. März 1901, S. 244 ff.

outbreaks of Trachoma in schools in Prussia, and decrees that infectious diseases of the eye in schools shall be treated by the Board of Health. The terms of the measure are as follow:

The increase of Trachoma in various parts of the monarchy renders it essential that greater attention shall be paid to the prevention of the spread of infection in schools. Experience shows that it is frequently in schools that outbreaks in towns first come under the notice of the authorities. Moreover, the disease not infrequently spreads from family to family through the agency of schools.

We have therefore caused the scheme of the order of July 14th, 1884, so far as it deals with infectious eye diseases, to be remodelled in accordance with more recent experience, and hereby forward it with the request that all necessary steps may be taken for carrying out its injunctions.

We attach considerable importance to the co-operation of both male and female teachers in the prophylactic treatment of Trachoma in schools. In this respect they have proved on many occasions in the eastern provinces of much help to the surgeons, and under their instruction and control they can render good service in future.

DIRECTIONS FOR THE PREVENTION OF THE SPREAD OF INFECTIOUS DISEASES OF THE EYE IN SCHOOLS

1. The following are the diseases of the eye, the contagious nature of which render special rules necessary for schools :—

(*a*) Blennorrhœa and diphtheritic conjunctivitis.

(*b*) Acute and chronic catarrh of the palpebral conjunctiva, and granular conjunctivitis (Egyptian ophthalmia, Trachoma).

2. Efforts should be made that every case of infectious disease of the eye occurring in any scholar or any of his relatives be immediately notified by the person in charge of the scholar to the head teacher of the school.

3. All scholars suffering from the diseases mentioned under 1*a* must always be kept away from school ; those suffering from diseases in 1*b* only when or as long as they have discharge from the eyes.

4. Those scholars suffering from diseases in 1*b*, having no discharge, and those free from disease, but belonging to a family in which a case of infectious disease (1*a* or 1*b*) has occurred, may attend school, provided special places are allotted to them sufficiently far apart from the healthy scholars.

5. Scholars debarred from attending school under sect. 3, or placed

apart in school under sect. 4, cannot attend school, or resume their ordinary places, until they have received a medical certificate that all risk of infection is past—the scholars themselves, as well as their clothes, having been thoroughly disinfected.

6. The head teacher of the school is responsible for the observance of rules 3 to 5. He shall immediately notify to the police authorities of the town the fact of any child being debarred from attending school on account of an infectious disease of the eyes.

7. Scholars may be allowed to go home from boarding-schools, seminaries, and similar institutions, during or immediately after an epidemic of an infectious eye disease, only when the surgeons are satisfied that they may do so without risk of spreading infection, and when all necessary precautions have been carried out.

8. Teachers and other school officials suffering from an infectious disease of the eyes (1*a* or 1*b*), shall give immediate notice of the same to the head teacher of the school and the local police.

If the patient live in the school-house itself, the head teacher shall see that he receives medical treatment, and that he is isolated, if it be deemed necessary by the surgeon.

If the patient lives outside the school, he shall not enter it during the course of the disease until he has received a medical certificate that there is no longer any risk of infection, and his clothing has been thoroughly disinfected.

If the patient suffer from any disease in class 1*b*, he shall continue to carry out his duties at school, provided and so long as he has no obvious discharge.

9. Teachers and other school officials in whose families a case of infectious disease (1*a* or 1*b*) occurs, shall give immediate notice of the same to the principal. If the case be one which comes under class 1*a*, they may discharge their duties during the course of the disease only if they receive a medical certificate that there is no danger of spreading the infection in the school.

10. Whenever several cases of infectious disease break out in a school, or in a place where a school exists, or in a neighbouring town from which children come to attend a school, the head teacher shall lodge a request with the president of the local board (*Oberamtmann*), or in towns which form a district council with the chief of police, to have teachers, scholars, and all persons living in the school examined by the medical officer of health. The authorities shall decide according to the report of that officer whether, and how often, such examination shall be repeated.

11. The police authorities of the town shall provide for the treatment

of the scholars who are suffering from infectious diseases, unless the parents have received a medical permit to undertake the same.

12. While any infectious disease is present in a school, the school premises, schoolroom, and lavatories shall be thoroughly cleaned every day, the schoolroom thoroughly ventilated when the classes are over, and the lavatories disinfected under the supervision of the police; and after school is over, the door-handles, slates, and forms shall be washed daily with a lukewarm 1 per cent. solution of soft soap and carbolic acid in water.

This rule also applies to the institutions mentioned under 7, in which it further extends to the day-, work-, and bed-rooms.

13. It will be only in very rare cases necessary to close the whole school on account of an infectious eye disease, and this can only be done by the president of the local board, or in towns which form a district council by the chief of police, according to the report of the medical officer. Such a course in follicular conjunctivitis is scarcely ever necessary, and in Trachoma only when a considerable number of the scholars have purulent discharge.

If there be danger in delay, the head teacher and the local police authorities may close the school temporarily, on the advice of the medical officer, but shall immediately notify the same to the school inspector and the president of the local board.

14. The reopening of a school or class which has been closed or stopped for some infectious disease can only be effected by an order from the president of the local board, or, in towns which form a district council, from the chief of police. The school must first be thoroughly cleaned and disinfected.

15. Rules 1 to 14 also apply to private schools and seminaries, continuation schools, technical schools, infant schools, crèches, kindergarten, etc.

There is nothing of importance to add to this code, which is extremely practical, and does justice to modern views on the Trachoma question. As regards the careful cleansing of the school premises as prescribed under 12, this refers to the removal of dust, which must be done every day with a damp cloth, the floors, which should be varnished, being similarly treated. Unfortunately schools are often not kept thoroughly clean from want of a sufficient staff.[1] One caretaker is not sufficient for such work in a large school.

[1] *Cohn*, loc. cit. S. 150.

It may also be mentioned in passing that suitable instruction should be given to the scholars on the prevention of infection with Trachoma. Lectures on the nature, significance, signs, and curability of Trachoma, delivered to the upper classes in seminaries in Trachoma provinces, would be very useful for the purpose of educating the teachers of elementary schools in this important hygienic problem.[1]

Teachers will, above all, have to keep a strict watch on the scholars, especially in country schools, with regard to scrupulous cleanliness of clothes and persons, particularly faces and hands. The establishment of school baths is said to have proved satisfactory, but such a scheme cannot be carried out universally. It must always remain the duty of parents to look after the personal cleanliness of their children.

The district medical officers were first ordered to superintend the sanitary condition of schools, but since they have much other official work to do, it was thought advisable to employ special school surgeons in addition; and these, according to reports, have worked well in all towns where they have been appointed. Their appointment in Trachoma disticts was made dependent upon their possessing a certificate of proficiency, showing that they had duly attended a full course of instruction in Trachoma.

In Königsberg (Prussia), in the summer of 1897, Kuhnt found an alarming epidemic of Trachoma in the schools, especially the elementary schools, and special Trachoma surgeons were then first appointed and classes on Trachoma instituted. The affected scholars were treated in large numbers in the clinics, many of them being compelled to attend. In six months the disease was so far reduced that it was no longer considered necessary to enforce to the full extent the measures which interfered seriously with the work of the schools.[2] However, the prevalence of

[1] *Kuhnt*, loc. cit. S. 168 f.

[2] *E. von Esmarch*, Zeitschrift für Schulgesundheitspflege 1899, S. 2.

Trachoma in elementary schools, the length of time that it might spread insidiously without being detected, and the difficulty and cost of suppressing it, convinced the municipal authorities that the recurrence of such a condition could only be prevented by keeping a continuous control over the schools. Accordingly, it was resolved in 1898 to appoint ten school oculists, who took the place of the Trachoma surgeons, and entered on their duties—at first chiefly those of fighting Trachoma—with a special code of regulations. Their duties, according to sect. 5 of this code,[1] included "the biennial examination of all the school buildings as to sanitary condition, with the assistance of the head master and the town surveyor."

Since 1896 the struggle with Trachoma in Prussia has been vigorously taken up by the State, aided by the Act already alluded to. Indeed, various considerations went to show that, next to the army, the school is the most important starting-point for the disease: not that Trachoma is essentially a school complaint, but because the authorities quickly know of any outbreak among the scholars, whereas it usually escapes notice among adults. Moreover, by investigating the source of trachomatous infection among school children, the infected families and homes are invariably examined, so that the real hotbed of the disease is discovered, and its true extent is determined as surely and quickly as possible.

Periodical inspection of the schools is made whenever isolated cases of Trachoma are reported: the results of these inspections are recorded in registers, and form the basis of useful statistics of Trachoma. We have already stated that fault has frequently been found with the rules by which these registers are kept. We have given an account of proposed amendments, and have advised the adoption of Hirschberg's plan—viz. that the patients should be differentiated, according to the severity of the attack, into four groups—suspicious (s), mild (m), moderate (M),

[1] *E. von Esmarch*, loc. cit. S. 4.

bad (b). The tests for these groups have already been given in Chapter V. After all, the principal aim should be to cure as many patients as speedily as possible; and it is only by curing large numbers in areas where the disease is endemic—*i.e.* by rendering innocuous as many carriers of infection as possible—that the disease can be ultimately stamped out.

By systematically ridding the schools in a Trachoma district of the disease, we may in a reasonable time hope to succeed in freeing the rising generation entirely, thus keeping them fit for work and military service.

In children the method of expression, followed by the application of medicaments, is first indicated; excision should only be resorted to in a case of necessity. From the hygienic point of view the most important cases are the moderately severe ones (M), with numerous follicles on both lids and over the tarsus, very prominent upper fornix, and copious discharge. These cases are at once prohibited from going to school, because of their contagiousness. After a few weeks of special treatment in a hospital, best by expression or, if necessary, by excision, they can usually be transferred into group (m)—mild cases without discharge—and are allowed to attend school again. In order to be better under supervision, they must sit apart in the front seats, and continue under medical treatment as long as any follicles are visible. They are then classed as (s). These need only continue under medical supervision, without active treatment, as any swelling of the conjunctiva can be best treated by simple hygienic measures. Finally they are struck off the register as healthy. The bad cases (b), with gelatinous Trachoma or with sequelæ, are treated like the moderate cases, and when they show improvement they are transferred into group (M), (m), or (s). Cases that have passed the inflammatory stage and are quiet and cicatrised may without hesitation be allowed to go to school.[1]

[1] *Greeff*, loc. cit. S. 68.

From the fact that the chief centres of the disease are found in poor, agricultural districts, away from the great lines of commerce, where, in keeping with the lowly grade of the inhabitants, there is no good supply of medical men, it must be the first consideration to secure more extensive assistance of thoroughly experienced surgeons. In addition, the assistance of the laity will be the more indispensable, as the poor patients are not in a position to take long journeys to the doctor every day or several times a week. The medical assistance, however, must be carried out on a definite principle, with uniform methods of treatment, and as far as possible simultaneously in all affected areas. It must therefore be controlled from a common centre.[1] This centre should give special courses of instruction on Trachoma, and also spread over the infected country a network of medical stations, each of which has to clear a certain district under the supervision of an experienced surgeon, who is in constant communication with it. Thus, taking the province of East Prussia for example, at the conference on Trachoma held in Königsberg on August 10th, 1897, it was resolved that preventive measures should be carried out in the individual districts if they showed a moderate or serious infection. Part of the expense was thrown on the districts, an adequate sum in addition being voted by the State. The treatment was to be given gratuitously, and undertaken by skilled Trachoma surgeons at a fixed sum.

As a means of combating the disease it was proposed to open numerous dispensaries, where patients could be treated as out-patients, usually in co-operation with the district or city hospitals, or in the schools with the assistance of the teachers, who were paid for their services, or of nurses, who are reported to have been of great use in putting in drops, bathing eyes, etc., under the supervision of the surgeons. When occasion required, the patients were transferred to the district hospitals or to the specially erected Trachoma

[1] *Raehlmann*, Ueber die Nosologie des Trachoms, etc. S. 637.

hospital in Königsberg as in-patients. Moreover, the schools were examined every six months, or oftener, if necessary, by specially appointed "district oculists," who, if the condition of the place demanded it, were authorised to inspect private institutions, such as boarding-schools, seminaries, etc., and even families and the inhabitants of whole districts.

We consider it absolutely necessary to make this out-patient treatment[1] as extensive as possible, because the people prefer it, and it is more suited to the conditions of social misery which obtain.

It will, nevertheless, be essential to treat as in-patients of hospitals all serious cases complicated with affection of the cornea, and especially those in which some operative precedure, such as excision, peritomy, plastic operations on the lids, extirpation of the lacrymal sac, etc., has to be performed, and, finally, those infectious cases with discharge, in which it is from the first very doubtful if preventive measures have been taken—*e.g.* very dirty, indolent people and people crowded together in lodgings. Special watch is made over the night lodgers by the sanitary authorities.

The treatment is to be given to in-patients and out-patients alike, and, in the case of very needy persons, compensation is given for the loss of wages entailed by the treatment. Where the conditions in a place are very bad, it is recommended to erect portable barracks, to which an experienced oculist is sent for several months.[2]

We have already referred to courses of instruction on Trachoma. These are intended to give uniform training in diagnosis and treatment to as many medical men as possible in a Trachoma district. Attendance at these courses, lasting about three weeks, are to be compulsory for all medical officers in the affected provinces, and optional for private practitioners.

After several years of personal experience acquired in

[1] *Richter*, loc. cit. S. 5.

[2] *Hirschberg*, Zur Bekämpfung der endemischen Körnerkrankheit 1900, S. 8.

Trachoma districts, the author is unable to give a shorter and apter *résumé* of the main guiding points for treatment than by quoting Kuhnt's words[1]: "In infected districts the mechanical methods (expression, etc.) are, generally speaking, only to be recommended for persons belonging to the better classes, for intelligent persons belonging to the working classes, endowed with a due regard for cleanliness, because it is only in these two classes that we can be sure that re-infection will not necessarily occur. For the great mass of patients some operative procedure suited to the individual case, and carried out with caution, may be indicated at the outset. Finally, in all bad cases, even in non-infected areas, where the fornix remains persistently swollen and the tarsus thickened, in spite of repeated expression, the only proper treatment, in my opinion, is a suitable excision. Yet I trust there will no longer be any doubt that it shows as little discrimination to advocate the use of mechanical methods on the one hand, as to shower unstinted praise on the method of excision on the other. Both methods deserve consideration, and give good results, but—each in its place!"

We cannot lay too much stress on the fact that in order to ensure a permanent cure, it is absolutely necessary to keep apparently cured cases under medical supervision for a long period. The frequent absence of such control is the chief cause of the numerous relapses. This supervision will have to be continued at least as long as any signs of inflammation remain; in obstinate cases which come too late under treatment sometimes as long as the patients live. This, however, may be done with the least amount of inconvenience,[2] so that it suffices for many patients with cicatricial Trachoma to report themselves once a year. Many of these people are fit to work, and may continue their work without danger when the discharge has ceased, with the exception of some special vocations,

[1] *Kuhnt*, Ueber den Heilwert der mechanischen Methoden, etc. S. 20.

[2] *Axenfeld*, loc. cit. S. 34.

such as children's nurses, for then any temporary inflammation accompanied by discharge might infect a whole family.

The results which have hitherto been obtained by State interference in Prussia prove that we are on the right track. For example, in the Königsberg division, official reports[1] show that Trachoma diminished greatly in 1898-9 in eleven out of sixteen districts where it was endemic; in three districts it remained about the same; in two (Ortelsburg and Neidenburg) the number of cases was distinctly greater, as compared with previous examinations. In 1899—1900 a further reduction in Trachoma was seen in almost every district. Unfortunately the value of the statistics is diminished by the fact that cases of ordinary follicular conjunctivitis were often diagnosed and treated as Trachoma.

Moreover, the number of cases of Trachoma was found to be distinctly less at the inspection of recruits in the above-mentioned divisions in 1900. The remarkable variations in the individual districts, however, makes it doubtful if the treatment of grown-up people was responsible for the result, or if it was a matter of chance or inaccurate observation.

The treatment of school children has, on the whole, been attended with success. In Königsberg, for example, in 1897, Kuhnt found 790 cases of Trachoma and 484 suspicious cases out of a total of 17,553 children in elementary and secondary schools. The ten Trachoma surgeons who were appointed by the city then examined all the schools, and found altogether 5,847 scholars suffering from the disease. Of these, 34 were treated in the clinics, 525 at their own homes, 1,067 in 27 special Trachoma classes, and 4,221 in the schools by teachers under the supervision of the surgeons.

In March, 1899, there were 538 scholars with Trachoma out of 17,554 children in the elementary and secondary

[1] Das Sanitätswesen des preuss. Staates 1898—1900, S. 137.

schools in Königsberg. This number sank within six months to 393, in spite of the fact that 130 fresh cases appeared. Moreover, the cases had become less severe. Accordingly, the special classes for trachomatous scholars could be done away with.

The school surgeons appointed in place of the Trachoma surgeons had to refer trachomatous scholars to various selected hospitals and oculists, who expressed their willingness to treat the children out of school hours.

The treatment of adults was not attended with the same success. In spite of public instruction and the promise of treatment gratis, the patients attended the out-patient department a few times and never returned. The district nurses who were appointed, and who proved of great service, complained everywhere about the irregular attendance. Even the threat of punishment by the police proved of no avail.

The method of transferring whole infected families at once to the hospital proved most useful. Of course, the length of their stay, which could not extend on an average beyond four to six weeks, was usually insufficient to effect a permanent cure. The drawback was again felt when the patients were discharged that the very essential after-treatment was submitted to with great irregularity.

Owing to the lack of medical men in these parts, and the deficient means of transport, the teachers have proved invaluable—indeed, indispensable—for outdoor treatment of the scholars and the after-treatment of operated cases. Not infrequently they have discovered sporadic cases in non-infected schools.

The Trachoma patients discovered by the recruiting department were generally referred to the hospitals for treatment. By the treatment of infected school children and young men liable for service, the spread of Trachoma in other Government divisions, according to the official reports, became markedly reduced from 1898 to 1900, and much milder in character.

This success was an encouragement to the State to continue on the same lines. It is probably necessary in doing so to have some laws to enforce the regulations; but we cannot hide the fact that even the best laws remain to some extent ineffective if unaided by the good will and intelligence of the classes for whose benefit they are framed. In order to ensure perfect success, sanitary legislation must go hand in hand with the enlightenment and training of the people in sanitary matters, while all unnecessary compulsion must be avoided. As M. Kirchner[1] rightly points out, printed instructions on posters and placards at railway stations, registrars' offices, churches, schools, etc., are of little use to the man in the street. They would effect more if they were made the subject of discussions by prominent persons, such as the clergy, teachers, landlords, etc. This has often been done with good results.

It is also quite obvious that great importance must be continuously laid upon the training of the people, particularly school children, in habits of cleanliness. An epidemic of Trachoma, as we know, generally breaks out only among the uncultured and ignorant people, who are also usually poor and dirty; it is notably prevalent in those Prussian provinces where the "elf-lock" is found. Still, with the social misery which is so common in the Trachoma districts, the best efforts at instruction and training avail little so long as the general sanitary conditions of the poor, and especially their wretched dwellings, are unimproved. Providing the poorer agricultural and labouring classes with bright, healthy, airy, and roomy schools and houses, and the *general improvement of the public health* in the country, as attempted by numerous friendly, commercial, and other societies, form certainly the most important and beneficial measures for the prevention of Trachoma.

In the same manner, all efforts towards the improvement of the condition of the people in the infected eastern

[1] *Kirchner, M.*, loc. cit. S. 18.

provinces will be facilitated by putting down the liquor traffic, providing home industries, and promoting commercial interests, as well as by all efforts directed to improving the culture and health of the populace. By following these lines, making, when necessary, suitable international agreements, there can be no doubt, in the face of the great forward movement in public health at the present time, that the extermination of Trachoma in the German Empire is only a question of a few decades, and the disease will, like leprosy, at no distant date become merely a matter of history in all highly civilised nations.

BIBLIOGRAPHY

Aerztliche Sachverständigen-Zeitung 1903.

Aktenstücke über die kontagiöse Augenentzündung. Auf Veranlassung des Ministeriums der geistlichen, Unterrichts- und Medizinal-Angelegenheiten herausgegeben. Berlin 1822.

Alt, On the Histology of Trachoma. Americ. Journ. of Ophthalm. 1886.

Andogsky, Ueber operative Behandlung des Xerophthalmus trachomatosus. Archiv für Augenheilkunde, Bd. XXX.

Annales d'Oculistique 1874, 1893.

Archiv für Augenheilkunde von Knapp und Schweigger, Bd. XXX. XL.

Archiv für Kinderheilkunde, Bd. XXV.

Archiv für mikroskopische Anatomie, Bd. III. 1867.

Archiv für Ophthalmologie von v. Graefe, Bd. XIV. XV. XXV. XXIX. XXXVI.

von Arlt, Die Krankheiten des Auges. Prag. 1860.

Assalini, Observations sur la peste et l'ophthalmie d'Egypte 1816.

Axenfeld, Das Trachom. Freiburg i. Br. 1902.

Bach, Zur geographischen Verbreitung und Statistik des Trachoms in der Provinz Oberhessen und den angrenzenden preussischen Provinzen. Diss. Giessen 1897.

Baeck, Ueber den Zusammenhang zwischen Skrophulose und Trachom. Münchener medizinische Wochenschrift 1900.

Baltz, Ueber die Entstehung, Beschaffenheit und zweckmässigste Behandlung der Aug-Entzündung, welche seit mehreren Jahren unter den Soldaten einiger europäischen Armeen geherrscht hat. Utrecht 1822.

Bärenstein, Zur Behandlung der follikulären Entzündung der Bindehaut. (Aus *von Hippel's* Klinik.) Königsberg 1892.

Bauer, Das Trachom in der Ostschweiz. Korrespondenzblatt für Schweizer Aerzte 1900.

Beer, Die Lehre von den Augenkrankheiten. Wien 1813.

Bendz, Quelques considérations sur la nature de l'ophthalmie militaire en Danemark. Copenhague 1858.

Bericht über die 14. Versammlung der ophthalmologischen Gesellschaft zu Heidelberg 1882.

Berlin, Beiträge zur pathologischen Anatomie der Conjunctiva. Klinische Monatsblätter für Augenheilkunde 1878.

Berliner klinische Wochenschrift 1882, 1895, 1897, 1900.

Blumberg, Ueber das Trachom vom cellular-pathologischen Standpunkt. von Graefe's Archiv für Ophthalmologie, Bd. XV. 1869.

Bock, Ueber Trachom. Mit besonderer Berücksichtigung seines Vorkommens in Krain. Wien 1900.

Boldt, Zur Massage des Auges. Deutsche militärärztl. Zeitschrift 1900.

British Medical Journal 1899.

Bull, Ole, Prädisponierende Ursachen des Trachoms. Zentralblatt für praktische Augenheilkunde 1896.

Burchardt, Ueber die Ursache und Behandlung der Körnerkrankheit des menschlichen Auges. Zentralbl. f. prakt. Augenheilk. 1897.

Cazalis, Étude bactériologique sur la conjonctivite granuleuse 1895.

Chibret, De l'immunité de la race celte vis-à-vis du trachome. Verhandlungen des X. internat. mediz. Kongresses, Bd. IV. Abt. 10. Berlin 1891.

Cirincione, Struktur und Pathologie der Tränenwege. Zentralbl. f. prakt. Augenheilk. 1901.

Cohn, Bindehautkrankheiten unter 6000 Schulkindern. Zentralbl. f. prakt. Augenheilk. 1877.

Cohn, Lehrbuch der Hygiene des Auges. Wien und Leipzig 1892.

Comptes-rendus du XII. congrès international de médecine. Moscou 1898. Vol. VI.

Czaplewski, Sitzungsbericht des Vereins für wissenschaftliche Heilkunde in Königsberg vom 8. März 1897.

Decondé, Mémoires sur différentes questions, qui se rattachent à l'ophthalmie de l'armée. Bruxelles 1841.

Deneffe, L'ophthalmie granuleuse en Belgique 1893.

Deutsche medizinische Wochenschrift 1897, 1898, 1901, 1903.

Deutsche militärärztliche Zeitschrift 1893, 1900.

Dienstanweisung für die Kreisärzte vom 23. März 1901.

Ebert, Zur Trachomfrage der k. und k. Armee. Wien 1898.

Eble, Ueber den Bau und die Krankheiten der Bindehaut des Auges mit besonderer Beziehung auf die kontagiöse Augenentzündung. Wien 1828.

Eble, Die sogenannte kontagiöse oder ägyptische Augenentzündung. Stuttgart 1839.

Ebstein, Die Krankheiten im Feldzuge gegen Russland (1812). Stuttgart 1902.

Ellinger, Weitere Mitteilungen über therapeutische Verwertung des Sanguis anguillae. Geneeskundig Tijdschrift voor Nederl.-Indië 1902.

Eloui, Mohamed, Contribution à l'étude de la granulation conjonctivale, de sa nature et de sa prophylaxe dans les écoles. Caire 1902.

Elze, Ueber Plasmodienfunde bei Trachom. Zwickau 1897.

von Esmarch, E., Schulärztliches. Zeitschrift für Schulgesundheitspflege 1899.

Eulenburg, Real-Encyklopädie der gesamten Heilkunde. 2. Aufl. Bd. IX. 1887.

Eyre, Die Tuberkulose der Conjunctiva. Arch. f. Augenheilk. 1900, Bd. XL.

Falk, Ueber die geographische Verbreitung einiger Augenkrankheiten 1873.

Feuer, Das Trachom in der österreichisch-ungarischen Armee 1889.

Feuer, Die Verbreitung des Trachoms in Ungarn und das behördliche Vorgehen gegen dasselbe. Stuttgart 1897.

Fialkowsky, Sanitätsstationen für Augenkranke. Wojenno-sanitarnoje Djelo 1883.

Frölich, Heereskrankheiten. Eulenburg's Real-Encyklopädie, 2. Aufl. Bd. IX. 1887.

Fuchs, Die ägyptische Augenentzündung. Wiener klin. Wochenschrift 1894.

Fuchs, Lehrbuch der Augenheilkunde 1898.

Galezowski, Étude sur les granulations palpébrales fausses et néoplastiques. Recueil d'Ophthalmologie 1874.

Germann, Statistisch-klinische Untersuchungen über das Trachom. Diss. Dorpat 1883.

Germann, Zur Aetiologie des Trachoms. St. Petersburger mediz. Wochenschrift 1890.

Germann, Augenärztliche Beobachtungen in Syrien und Palästina, speziell über das Trachom in diesen Ländern. Zentralbl. f. prakt. Augenheilk. 1896.

Gesetz betreffend die Bekämpfung gemeingefährlicher Krankheiten vom 30. Juni 1900.

Goldzieher, Beiträge zur Therapie des Trachoms. Wiener mediz. Wochenschrift 1902.

Graefe, C. F., Die epidemisch-kontagiöse Augenblennorrhoe in den europäischen Befreiungsheeren. Berlin 1823.

Graefe und *Saemisch*, Handbuch der gesamten Augenheilkunde, Bd. IV. 1876; VII. 1877; XII. 1899.

Greeff, Studien über epidemische Augenkrankheiten. Jena 1898.

Haeser, Geschichte der epidemischen Krankheiten. Jena 1865.

Hairion, Anatomie pathologique des granulations palpébrales. Bruxelles 1850.

Hasner, Entwurf einer anatomischen Begründung der Augenkrankheiten. Prag. 1847.

Heisrath, Ueber die Behandlung der granulösen Bindehautentzündung mit tiefen ausgedehnten Excisionen. Berl. klin. Wochenschr. 1882.

Himly, Die Krankheiten und Missbildungen des menschlichen Auges. Berlin 1843.

von Hippel, Beitrag zur Behandlung des Trachoms. Verhandlung der 12. Sitzung der ophthalm. Gesellschaft zu Heidelberg, 1891.

Hirsch, Geschichte der Ophthalmologie. Handbuch der gesamt. Augenheilkunde von Graefe und Saemisch, Bd. VII. 1877.

Hirschberg und *Krause*, Zur Pathologie der ansteckenden Augenkrankheiten. Zentralbl. f. prakt. Augenheilk. 1881.

Hirschberg, Aegypten. Geschichtliche Studien eines Augenarztes. Leipzig 1890.

Hirschberg, Ueber die körnige Augenentzündung in Ost- und Westpreussen und ihre Bekämpfung. Jena 1897.

Hirschberg, Ueber die geographische Verbreitung der Körnerkrankheit. Deutsche med. Wochenschrift 1897.

Hirschberg, Der Kampf gegen die Volkskrankheit Trachom. Archiv für Kinderheilkunde, Bd. XXV.

Hirschberg, Die Blindheit in Spanien. Zentralbl. f. prakt. Augenheilkunde 1898.

Hirschberg, Geschichte der Augenheilkunde. Handbuch der gesamt. Augenheilkunde von Graefe-Saemisch, Bd. XII. 1899.

Hoor, Prophylaxe und Beseitigung des Trachoms in der k. und k. österreichisch-ungarischen Armee. Wien 1893.

Hoppe, Die Erfolge der Bindehaut-Knorpelausschneidung bei Trachom. Klin. Monatsblätter f. Augenheilk. 1898.

Hoppe, Ist das Trachom eine Krankheit der frühesten Jugend? Stuttgart 1901.

Horstmann, Bericht über die Leistungen und Fortschritte in der Augenheilkunde 1897.

Hourmouziadès, De la conjonctivite granuleuse. Paris 1902.

Imre, Die Ursachen der Blindheit im ungarischen Niederlande. Zeitschrift f. Augenheilk. Bd. III. 1900.

Ischreyt, Zur Geschichte der Blindenstatistik in Russland. Zentralbl. f. prakt. Augenheilk. 1895.

Iskersky, Wie ist die Zahl der Augenerkrankungen in der russischen Armee zu vermindern? Wjestnik oftalmologii 1893.

Iwanoff, Zur pathologischen Anatomie des Trachoms. Bericht der 11. Versamml. der ophthalm. Gesellschaft zu Heidelberg 1878.

Jacobson, Sen., Beiträge zur Pathologie des Auges. Leipzig 1888.

Jacobson, Jr., Ueber Epithelwucherung und Follikelbildung in der Conjunctiva mit besonderer Berücksichtigung der Conjunctivitis granulosa. von Graefe's Archiv, Bd. XXV. 1879.

Jäger, F., Die ägyptische Augenentzündung. Wien 1840.

Jitta, Statistisches über das Trachom in Amsterdam. Nederlandsch Tijdschrift voor Geneeskunde 1899.

Jüngken, Ueber die Augenkrankheit, welche in der Belgischen Armee herrscht. Berlin 1834.

Junius, Ueber die Entwickelung und den heutigen Stand unserer Kenntnisse von der pathologischen Anatomie und Aetiologie des Trachoms. Zeitschrift f. Augenheilk. Bd. I. 1899.

Junius, Die pathologische Anatomie der Conjunctivitis granulosa nach neuen Untersuchungen. Zeitschrift f. Augenheilk. Bd. VIII. 1902.

Kerschbaumer, Putiata, Bericht einer okulistischen Abteilung in Sibirien. Zeitschrift f. Augenheilk. Bd. VII. 1902.

Kirchner, M., Grundriss der Militär-Gesundheitspflege. Braunschweig 1896.

Kirchner, M., Die Bekämpfung der Körnerkrankheit (Trachom) in Preussen. Berl. klin. Wochenschrift 1897.

Klinisches Jahrbuch, Bd. IX.

Kob, Ueber Prophylaxe des Trachoms in der Armee. Diss. Königsberg 1901.

von Kobylecki, Das Trachom als Volkskrankheit und seine Bekämpfung durch den Staat. Zeitschrift f. Medizinalbeamte 1897.

Königshöfer, Die Prophylaxe in der Augenheilkunde. Aus Nobiling-Jankau, Handbuch der Prophylaxe, Abt. XII. München 1901.

Kontagiöse Augenentzündung, Die, in der Armee und Direktiven zur Untersuchung und Beurteilung Militärpflichtiger. Aus den Akten der Medizinal-Abteilung des Kriegsministeriums. Deutsche mil.-ärztl. Zeitschrift 1893.

Korrespondenzblatt für Schweizer Aerzte 1900.

Kramsztyk, Die Schwierigkeiten des klinischen Studiums des Trachoms. Krytyka Lekarska 1878.

Kuhnt, Ueber die Therapie der Conjunctivitis granulosa. Jena 1897.

Kuhnt, Ueber den Heilwert der mechanischen Methoden in der Therapie der Conjunctivitis granulosa. Berlin 1899.

Kuhnt, Eine Modifikation der Anwendungsweise des Expressors bei der Conjunctivitis granulosa. Berlin 1899.

Larrey, Mémoires sur l'ophthalmie regnante en Egypte. Paris 1803.

Lawrentjew, Schwäche der Augen bei den Rekruten und Verschlechterung derselben in Folge des Soldatenlebens. Wojenno-medizinski Journal 1887.

Lawrentjew, Die Verbreitung des Trachoms in den fremdländischen Armeen und die Massregeln zur Bekämpfung desselben. Roth's Jahresbericht für 1892.

Lawson, Historical Review and Criticism of the Bacteriological History of Trachoma. The Royal London Opht. Hospital Reports 1897.

Leber, Ueber die Pathologie des Trachoms. Bericht der 25. Vesamml. der ophthalm. Gesellschaft zu Heidelberg 1896.

Lewkowitsch, Feuilletonistische Skizze über Augenkrankheiten in Süd-Afrika. Zentralbl. f. prakt. Augenheilk. 1897.

Lindén, Untersuchungen über das Vorkommen gewisser Krankheiten und Gebrechen in Finnland auf Grund der Ergebnisse bei den Assentierungen in den Jahren 1886-97. Finska Läkar. Hand. 1899.

von Linstow, Kriege, Schlachten und Belagerungen, bei denen nicht die feindlichen Waffen, sondern Krankheiten das entscheidende Moment waren. Deutsche mil.-ärztl. Zeitschrift 1900.

Ljubinski, Bericht über die Abkommandierung in die Häfen des Schwarzen Meeres zur Erforschung der Ursachen und Eigenschaften der unter den Untermilitärs verbreiteten Augenkrankheiten. Roth's Jahresbericht für 1889.

Löffler, Bemerkungen über d. sogenannte ägyptische Augenentzündung. Zeitschrift für Erfahrungsheilkunde 1849.

Löschmann, Zur staatlichen Bekämpfung der Granulose. Deutsche med. Wochenschrift 1901.

Logetschnikoff, Ueber den Trachomkokkus von Michel. Nagel's Jahresbericht für 1887.

Lucanus, Untersuchungen über die Verbreitung und Ansteckungsfähigkeit des Trachoms. Diss. Marburg 1890.

Mandelstamm, E., Der trachomatöse Prozess. von Graefe's Archiv, Bd. XXIX. 1883.

Martinson, Ueber die Häufigkeits- und Abhängigkeitsverhältnisse des Pannus bei Trachom. Diss. Dorpat 1886.

Marvaud, Les maladies du soldat. Paris 1894.

Matkowic, Contagion et thérapie du trachome. Recueil d'ophthalmologie 1898.

von Michel, Der Mikroorganismus der sog. ägyptischen Augenentzündung. Arch. f. Augenheilk. 1886.

von Michel, Lehrbuch der Augenheilkunde. Wiesbaden 1890.

Minici, Della ottalmia granulosa. Roth's Jahresbericht für 1891.

Müller, I. B., Die neuesten Resultate über das Vorkommen, die Form und Behandlung einer ansteckenden Augenliderkrankheit unter den Bewohnern des Niederrheins. Leipzig 1823.

Müller, Leopold, Ueber die ägyptischen Augenentzündungen. Arch. f. Augenheilk. Bd. XL. 1900.

Münchener medizinische Wochenschrift 1898, 1900, 1903.

Mutermilch, De la nature du trachome. Annales d'oculistique 1893.

Myrdacz, Sanitätsgeschichte des Krimkrieges. Wien 1895.

Nagel's Jahresbericht über die Leistungen und Fortschritte im Gebiete der Ophthalmologie (red. von Michel) für 1893, 1897.

Neese, Ueber Trachom und dessen Behandlung. Deutsche mediz. Wochenschrift 1897.

Nenadovic, Die Behandlung und die Bekämpfung des Trachoms. Comptes-rendus du XII. congrès international. Moscou 1898.

Nesnamoff, Zur Behandlung des Trachoms mit Jodlösungen. Zentralbl. f. prakt. Augenheilk. 1897.

Neumann, O., Die Prophylaxe im Militärsanitätswesen. München 1900.

Niedner, Die Kriegsepidemieen des 19. Jahrhunderts und ihre Bekämpfung. Berlin 1903.

Noiszewski, Der Mikroorganismus des Trachoms, Mikrosporon trachomatosum. Zentralbl. f. prakt. Augenheilk. 1890.

Oehrn, Zur Trachomstatistik in Livland. Zentralbl. f. prakt. Augenheilk. 1892.

Omodei, Cenni sull' ottalmia contagiosa d'Egitto. Milano 1816.

Ophthalmologische Klinik 1899.

Osborne, Augenärztliche Mitteilungen aus Aegypten. Arch. f. Augenheilk. Bd. XLII. 1901.

Papyrus Ebers, Das hermetische Buch von den Arzneimitteln der alten Aegypter. Leipzig 1875.

Passauer, Das öffentliche Gesundheitswesen im Regierungsbezirk Gumbinnen während des Jahres 1881. Gumbinnen 1882.

Peltzer, Die Ophthalmia militaris sive granulosa (aegyptiaca, bellica, contagiosa) vom modernen Standpunkte. Berlin 1870.

Peters, Bemerkungen zur Trachomfrage. Münch. med. Wochensch. 1903.
St. Petersburger medizinische Wochenschrift 1890.
Pilz, Lehrbuch der Augenheilkunde. Prag 1856.
Piringer, Die Blennorrhoe am Menschenauge. Graz 1841.
Prager, Die sogenannte militärische Ophthalmie vor der Königlich Belgischen medizinischen Akademie. Mediz. Jahrb. Bd. III.
Pröbsting, Ueber die Verbreitung der ägyptischen Augenentzündung in der Rheinebene und über die Mittel zur Bekämpfung derselben. Bonn 1896.
Progrès médical 1892.
Raehlmann, Pathologisch-anatomische Untersuchungen über die follikuläre Entzündung der Bindehaut des Auges oder das Trachom. von Graefe's Archiv, Bd. XXIX. 1883.
Raehlmann, Ueber Trachom. Sammlung klinischer Vorträge von Volkmann, No. 263. Leipzig 1885.
Raehlmann, Ueber den Heilwert der Therapie bei Trachom. Berlin 1898.
Raehlmann, Ueber die Nosologie des Trachoms in Preussen und ein Programm zur Ausrottung der Krankheit. Klin. Jahrbuch, Bd. IX.
Recueil d'ophthalmologie 1874, 1898.
Regulativ vom 8. August 1835, das bei ansteckenden Krankheiten zu beobachtende sanitätspolizeiliche Verfahren betreffend.
Reich, Das Trachom der Rekruten. Wojenno sanitarnoje Djelo 1883.
Reisinger, Ueber die Verbreitung der trachomatösen Augenentzündung in Böhmen. Graefe's Archiv, Bd. XXXVI. 1890.
Reitlinger, Zur Statistik der in den Truppenteilen der russischen Armee vorherrschenden Augenkrankh. Diss. St. Petersburg 1898.
Relazione medico-statistica sulle condizione sanitarie dell' esercito italiano, 1890—1900.
Report of the Surgeon-General of the Army to the Secretary of War, 1895-7.
Reutlinger, Historische Skizze der in der russischen Armee vorgekommenen Augenkrankheiten. Roth's Jahresbericht für 1886.
Richter, Wie haben wir uns die Bekämpfung des Trachoms zu denken? Zeitschrift für Medizinalbeamte 1898.
Römer, Die Bedeutung der Bakteriologie in der Pathologie des Auges. Würzburg 1901.
Roselli, Nouvelle cure du trachome. Comptes-rendus du XII. congrès internat. Moscou 1898.
Roth, A., Die Krankheiten des Sehorgans. Handbuch der Militärkrankheiten von Düms, Bd. III. 1900.
Roth W., Jahresbericht über die Leistungen und Fortschritte auf dem Gebiete des Militär-Sanitätswesens 1876—1901.
Roth und *Lex*, Handbuch der Militärgesundheitspflege, Bd. III. 1872-7.
Ruete, Lehrbuch der Ophthalmologie. Braunschweig 1854.
Rust, Die ägyptische Augenentzündung unter der Königlich Preussischen Besatzung in Mainz. Berlin 1820.

Samelsohn, Die Galvanokaustik in der Ophthalmotherapie. Archiv für Augen- und Ohrenheilkunde, Bd. III. 1872.

Sanitätsbericht über die Deutschen Heere im Kriege gegen Frankreich 1870-1.

Sanitätsbericht über die Königlich Preussische Armee, etc., 1875 bis 1900.

Sanitätswesen, Das, des Preussischen Staates während der Jahre 1890 bis 1900. Bearbeitet von der Medizinal-Abteilung des Kultusministeriums.

Sattler, Ueber die geographische Verbreitung des Trachoms. Verhandl. des X. internat. med. Kongresses. Berlin 1891.

Sattler, Die Trachombehandlung einst und jetzt. Berlin 1891.

Schlesinger, Die Ausbreitung des Trachoms und Follikularkatarrhs in Breslau während der letzten 32 Jahre. Wochenschrift für Therapie und Hygiene des Auges 1899.

Schmidt-Rimpler, Trachom und Conjunctivitis follicularis. Berl. klin. Wochenschrift 1895.

Schmidt-Rimpler, Pseudo-Trachom, durch Pflanzenhärchen veranlasst. Zentralbl. für prakt. Augenheilk. 1899.

Schmidt-Rimpler, Einige Bemerkungen über Trachom und epidemische Augenkrankheiten und deren Bekämpfung. Deutsche med. Wochenschrift 1898.

Schmidt-Rimpler, Augenheilkunde und Ophthalmoskopie. Leipzig 1901.

Schneller, Die Behandlung des Trachoms durch Excision der Uebergangsfalten. von Graefe's Archiv, Bd. XXX. 1884.

Schnitzler's Klinische Zeit- und Streitfragen 1899.

Schutzmassregeln bei ansteckenden Krankheiten. Herausgegeben vom Verein der Medizinalbeamten des Regierungsbezirks Potsdam. Berlin 1901.

Schweigger, Handbuch der Augenheilkunde. Berlin 1885.

Shongolowicz, Zur Frage von dem Mikroorganismus des Trachoms. St. Petersburger mediz. Wochenschrift 1890.

Silex, Kompendium der Augenheilkunde. Berlin 1902.

Statistik der Sanitätsverhältnisse der Mannschaft des k. und k. Heeres 1891—1900.

Statistischer Sanitätsbericht der k. und k. Kriegsmarine 1890-9.

Statistischer Sanitätsbericht über die Kaiserlich Deutsche Marine 1890 bis 1900.

Statistique médicale de l'armée belge 1890—1900.

Stellwag von Carion, Lehrbuch der Augenheilkunde. Wien 1870.

Stieda, Ueber den Bau der Augenbindehaut des Menschen. Archiv f. mikrosk. Anatomie, Bd. III. 1867.

Straub, Die Verschiebung der Schleimhaut der Uebergangsfalte auf den Tarsus beim Trachom. Zentralbl. f. prakt. Augenheilk. 1902.

Strebel und *von Ammon*, Die Aussichten der Lichtbehandlung in der Ophthalmotherapie. Deutsche medizinische Wochenschrift 1903.

Talko, Trachom im Heere und die prophylaktischen Mittel. Roth's Jahresbericht für 1887.

Tschetirkin, Ueber die Augenkrankheit, welche in der Kaiserlich Russischen aktiven Armee herrscht. Aus dem Russischen übersetzt von Magaziner. Kalisch 1835.

Uhthoff, Ueber den gegenwärtigen Stand der Bakteriologie bei den Bindehaut- und Hornhautentzündungen. Comptes-rendus du XII. congrès internat. Moscou 1898.

Verhandlungen des X. internationalen medizinischen Kongresses, Bd. IV. Abt. 10. Berlin 1891.

Vetch, Account of the Ophthalmia which appeared in England since the Return of the British Army from Egypt. London 1807. Uebersetzt von Michaelis, Berlin 1817.

Villard, Recherches sur l'anatomie pathologique de la conjonctivite granuleuse. Archives d'ophthalm. Bd. XVI. 1896.

Volkmann, Sammlung klinischer Vorträge, No. 263. Leipzig 1885.

Vossius, Statistik des Trachoms. Nagel's Jahresbericht für 1897.

Vossius, Lehrbuch der Augenheilkunde. Leipzig und Wien 1898.

von Walther, Ph., Die kontagiöse Augenentzündung am Niederrhein, besonders in der Arbeitsanstalt Brauweiler. Journal der Chirurgie und Augenheilkunde 1821.

de Wecker, Ueber die Art und Weise des Zustandekommens von Bindehautentzündungen. Ophthalmologische Klinik 1899.

Weiss, Statistik und Aetiologie der unter dem Landvolke Livlands am häufigsten vorkommenden Augenkrankheiten, besonders des Trachoms. Dorpat 1861.

Wernicke, O., Ueber Blindheit und Augenkrankheiten in Argentinien. Zentralbl. f. prakt. Augenheilk. 1897.

Wernicke, Th., Zur Aetiologie der Dakryocystitis acuta. Dorpat 1900.

Widmark, Zur Geschichte des Trachoms. Zehender's Klinische Monatsblätter f. Augenheilk. 1894.

Wiener klinische Wochenschrift 1894, 1897, 1900.

Wiener medizinische Wochenschrift 1902.

Wochenschrift für Therapie und Hygiene des Auges 1899.

Wolffberg, Einiges über die Verbreitung der ägyptischen Augenentzündung in Schlesien. Nagel's Jahresbericht für 1893.

Wolfring, Ein Beitrag zur Histologie des Trachoms. von Graefe's Archiv, Bd. XIV. 1868.

Wotypka, Die kontagiöse Bindehaut-Entzündung. Wien 1852.

Yarr, Trachoma and Race. British Med. Journ. 1899.

Zehender's Klinische Monatsblätter für Augenheilkunde 1878, 1891, 1898.

Zeitschrift für Augenheilkunde von Kuhnt und von Michel 1899—1902.

Zeitschrift für Medizinalbeamte 1897, 1898.

Zeitschrift für Schulgesundheitspflege 1899.

Zentralblatt für allgemeine Gesundheitspflege 1896.

Zentralblatt für praktische Augenheilkunde 1877—1903.

Ziehm, Zur Lehre vom Trachom. Wiener klin. Wochenschrift 1900.

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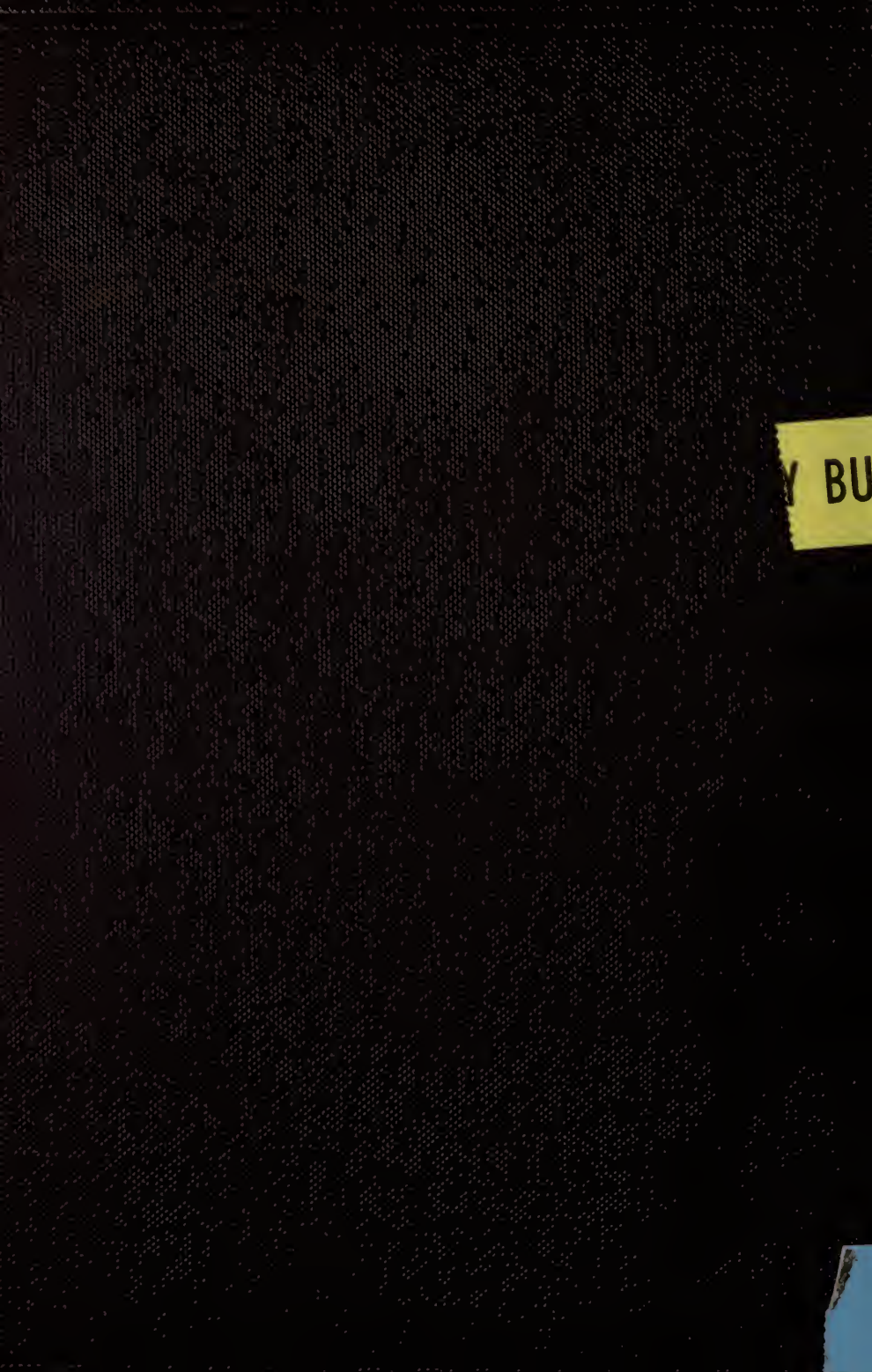
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